THE

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE,

PUBLISHED UNDER THE AUSPICES

OF THE

MADRAS LITERARY SOCIETY

AND

AUXILIARY OF THE ROYAL ASIATIC SOCIETY.

VOL. IV.

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EDITED BY

ROBERT COLE, Esq.

MADRAS MEDICAL ESTABLISHMENT,

SECRETARY TO THE ASIATIC DEPARTMENT OF THE SOCIETY.

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NATURAL HISTORY

PREFACE.

The completion of a Volume of the *Madras Journal of Literature and Science* in its enlarged form, and the commencement of another, seem to require a few words from its new Editor. It is a source of unmingled satisfaction to him that the anticipations he indulged in at the outset of his Editorship, expressed in the circular letter addressed to all parts of India, have been fully realized. Ample evidence has been adduced, in the pages of the two last and present numbers of the Journal, of its augmented dimensions having been required by the talent and intelligence existing within the Madras Presidency; and most gratifying testimony of public approbation is borne by the fact of a greatly enlarged subscription list.

It is with unfeigned humility that the Editor disavows any assumption of title or ability to lead public opinion, or to dictate to the world on matters of literature and science. He pleads only an ardent love of knowledge, and a desire for its increase and dissemination, as his qualifications for the office of a journalist :—looking to the master reapers in the wide regions of nature and of art, to bring their full ears of grain, while he performs the humble task of the labourer, who binds them together into the sheaf for the storehouse. If, in the performance of this lowly division of the intellectual process, he gives satisfaction to his contributors, and to the Society under whose auspices he labours, and is considered to have done any service to the cause of literature and science, he will rejoice at the appropriation of his leisure hours to the conduct of the Journal. He thinks it right further to deprecate austere criticism, by reminding readers that he undertakes the duties of Editor merely as an amateur. They are the pastime, only, of a life whose serious thoughts and studies are devoted to the public service and a laborious profession; and their performance is, necessarily, accomplished

only by the abandonment of ordinary recreations. Some allowances must also be made for the difficulties attendant on conducting a work through the press at Madras, the annoying extent of which can only be fully understood by those who have suffered under them. Brother Editors in Europe must not estimate our labours here, by their own share of the work in the publication of a volume.

Having premised thus much on the editorial management of the Journal, and entreating forgiveness for dwelling, even thus briefly, on what may have the semblance of egotism, the Editor would wish to draw the attention of the public to the nature and use of the publication itself, and to the SOCIETY under the auspices of which it is published.

There can be no doubt that a vehicle for conveying to the world notices of facts observed in the wide field of nature, of discoveries in the antiquities of India, and observations or treatises on the arts, literature, manners and customs of its inhabitants, was much needed in Southern India. The manner in which this Journal has been supplied with contributions since its commencement bears ample witness to that fact. At the same time it cannot be denied, that, though the subscription list is considerable, yet the publication would fall to the ground if it had been undertaken as a mercantile speculation by a publisher. The circumstance of its being published as the Journal of a Literary Society, prevents such a discreditable termination to its career of usefulness, as death from want of pecuniary sinews, when its intellectual resources were abundant. It is expected that the cost of publication will be nearly, if not quite, covered by the receipts, even if the sale of copies does not exceed the present amount.

Sir WILLIAM JONES, in his preliminary discourse, delivered on the occasion of the institution of the ASIATIC SOCIETY in BENGAL, after defining the bounds within which the researches of that body were to be carried on, proceeds to say: "If "now it be asked, what are the intended objects of our in- "quiries within these spacious limits, we answer, MAN and

" NATURE; whatever is performed by the one, or produced " by the other."

The bias of Sir WILLIAM JONES' mind led him to the study and cultivation of the first objects of his category, the *performances of man;* and there is no doubt that philologers, antiquaries and literati have been more numerous, in their several departments, than observers and historians of the *productions of nature.* Oriental scholars inform us that very much remains to be done in their department; and, assuredly, there is abundant scope for observation and inquiry in the boundless and beautiful domains of NATURE.

The intelligent and observant mind can never be in want of a subject, therefore; seeing that these exhaustless fields are open to him and inviting his notice and investigation. At the same time it is necessary to point out that the subjects suited for the pages of this Journal, by reason of the nature of the publication, and the circumstance of its issue by an *Asiatic Society*, are solely those which appertain, directly or indirectly, to Asia. Communications on the *belles lettres* of Europe, or on subjects immediately connected with the practical application of the learned professions, are, therefore, on this principle, clearly inadmissible.

A great deal may be effected, in the various branches of Natural Philosophy, by individuals possessing little acquaintance with the sciences. On this subject the language of the first living philosopher may be advantageously adduced.

" To avail ourselves as far as possible of the advantages which a division of labour may afford for the collecting of facts, by the industry and activity which the general diffusion of information, in the present age, brings into exercise, is an object of great importance. There is scarcely any well-informed person, who, if he has but the will, has not also the power to add something essential to the general stock of knowledge, if he will only observe regularly and methodically some particular class of facts which may most excite his attention, or which his situation may best enable him to study with effect. To instance one or two subjects, which *can*

only be effectually improved by the united observations of great numbers widely dispersed :—Meteorology, one of the most complicated but important branches of science, is at the same time one in which any person who will attend to plain rules, and bestow the necessary degree of attention, may do effectual service. What benefits has not Geology reaped from the activity of industrious individuals, who, setting aside all theoretical views, have been content to exercise the useful and highly entertaining occupation of collecting specimens from the countries which they visit ? In short, there is no branch of science whatever, in which, at least, if useful and sensible queries were distinctly proposed, an immense mass of valuable information might not be collected from those who, in their various lines of life, at home or abroad, stationary or in travel, would gladly avail themselves of opportunities of being useful. Nothing would tend better to attain this end than the circulation of printed skeleton forms, on various subjects, which should be so formed as, 1st, to ask distinct and pertinent questions, admitting of short and definite answers ; 2dly, To call for exact numerical statements on all principal points ; 3dly, To point out the attendant circumstances most likely to prove influential, and which ought to be observed ; 4thly, To call for their transmission to a common centre."*

Students in the various departments of knowledge throughout this part of India, are invited to make the Madras Journal this " common centre." It will be the Editor's duty, as occasion offers, to point out *desiderata,* and to present to his readers such rules for the guidance of the uninitiated as may be useful. With this view Sir John Herschel's directions for prosecuting the science of Meteorology, and the instructions of John Hunter for procuring and preserving specimens of Zoology, have been introduced into the *fourteenth number.*

* Herschel's Preliminary Discourse on the study of Natural Philosophy, p. 133.

Contributors may be assured that there is every certainty of their productions becoming extensively known. Besides a wide circulation of the Journal in India, a copy is presented to every Society, in this country and in Europe, established for the promotion of Oriental Literature; also to a great number of public literary and scientific institutions, in Great Britain and on the Continent of Europe, and to many public journalists throughout the world.

When the Journal was first set on foot it was anticipated that some pecuniary defalcation might occur; and this risk was cheerfully encountered by the SOCIETY, on the consideration that the outlay would conduce to the encouragement of literary and scientific tastes among the British residents within the proper sphere of its circulation, and that, the circle widening, our native fellow subjects might be induced to enter on the same pursuits; and thus a great deal of information might be collected and disseminated, which would otherwise not have come to light at all. There is no doubt that, a ready medium once afforded for communication with the world, intelligent persons are induced to observe and reflect on matters, which would otherwise obtain only a passing notice: and thus interesting discoveries are brought to light. The circumstance, too, of a literary and scientific periodical circulating among a widely spread community, like that comprized in the various public services in India, the individuals of which are all more or less known to each other, forms a grand incentive to intellectual emulation, and imparts an interesting character to the work, which ought to render every one desirous of contributing to its success and augmenting and extending its usefulness. With these claims on the grateful notice of the Madras Public, it is natural and proper to anticipate a continual accession of literary contributors, and a great increase to the subscription list. The SOCIETY, which publishes the work with no other view than the increase and diffusion of knowledge, has a well grounded right to call upon all enlightened persons to aid them in the attainment of such useful objects. It is unjust that the projectors should incur any

risk of pecuniary loss in so laudable an undertaking, and the Society has every reason to look for rescue from such a result. If the receipts were larger, some improvements might be effected in the publication; and any surplus funds would be most usefully employed towards the general objects of the Literary Society and Auxiliary Royal Asiatic Society.

And this leads to some notice of that Society itself, and to an expression of surprise that greater numbers do not avail themselves of the privilege of enrolling themselves among its Members. All who value knowledge and learning generally; or who are desirous of extending the benefits of European civilization, and the arts, sciences, and literature of the West, to our fellow subjects of India; or who, on the other hand, wish to carry out the investigations, still so far from completion, into the history, antiquities, philology and literature of the East; should become members of a body, pledged to the advancement of such purposes.

Another consideration is, that, circumstanced as British residents are in India, it is impossible to have a perfect library anywhere than at the Presidency; and it is derogatory to the character of our nation that, in such a capital as Madras, a collection of books of the most complete possible kind should not exist. A large accession of members would enable the Society to augment its library to an extent commensurate with the importance of our city, and befitting the numbers, wealth and intelligence of our countrymen throughout the Presidency. To resident members the advantages of such a library would be incalculable; occasional visitors to the Presidency would be enabled to obtain information on all points; and members in the interior, even, would have it in their power to make references to the depot of knowledge at Madras. A Museum, too, (the embryo only of which exists at present), might be perfected; so that students of Natural History might, at the outset of their career in India, obtain initiatory information, as to the advances we have made in Zoology, Botany, Mineralogy, Geology, &c.;

and proceed to the interior prepared to study and labour with advantage to themselves and benefit to science. Better accommodation, also, for the SOCIETY and its property might be secured, than two confined corners in a building the greater part of whose accommodations are appropriated to multifarious uses and occupations!

Now, some, perhaps all, of these advantages may be secured by the accession of fifty fresh resident members, and two or three hundred non-residents.

Are these to prove Utopian dreams?

Let those interested in Science and Literature, and in the spread of knowledge, decide.

To the PATRON of the SOCIETY, Sir FREDERICK ADAM, the enlightened promoter of every useful and beneficent design, the Journal owes in a great measure its existence, from the countenance and encouragement he afforded when its establishment was first proposed by the late lamented Colonel COOMBS; and his fostering hand has been since continually extended to it in a variety of ways, and in none more usefully than in proffering access to valuable documents in the public archives on the statistics of the Peninsula of India, from which, when time permits, it is expected that much highly interesting and important matter may be extracted.

As these observations will issue from the Press, when Sir FREDERICK ADAM, will have quitted, or be in the act of leaving, the shores of Madras, this parting tribute of grateful respect will occur opportunely.

R. C.

MADRAS: *27th January* 1837.

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Cavery R.
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Coleroon R.
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2. Sienitic Granite
3. Pegmatite
4. Protogine
5. Hornblende Rock
6. Gneiss
7. Hornblende Slate
8 Silicious Slate
9 Actynolite Slate
10 Eurite
11 Porphyry
12 Sienite
13 Basalt
14 Kaolin
15 Conglomerate Laterite
16 Lateritic Detritus
17 Quartzy Detritus
18 Magnesite
19 Ancient Kankar
20 Tufaceous and Nodular Modern Kankar
21 Magnetic Iron ore
22 Stalactitic Iron ore
23 Chlorite Slate

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 12.—*July,* 1836.

1.—*Notes on the Geology of the Country, between Madras and the Neilgherry Hills, viâ Bangalore and viâ Salem.—By* P. M. Benza, Esq. M. D. *of the Madras Medical Establishment.*

" What benefits has not Geology reaped from the activity of industrious individuals, who setting aside all theoretical views, have been content to exercise the useful and entertaining occupation of collecting specimens from the countries which they visit."* J. F. W. Herschel.

Before entering into the detailed remarks on the geology of the places I passed through, I think that a concise statement of the geological features of the plain near Madras, would be of some utility to the generality of readers, inasmuch as it would make them acquainted with the names and nature of the rocks, which they must have seen often, and to which reference is frequently made in these Notes.

Granite seems the lowest rock in almost all localities of this plain, and it is composed, in general, of the three usual minerals, quartz, felspar and mica, their relative proportion varying occasionally (No. 1). †

In almost all the borings for the water, and excavations for tanks and wells, which I have had an opportunity of visiting, granite has been always the lowest rock.

This rock is observed also at the surface of the soil, forming clustered masses of rock, or small eminences, in many parts of this plain;

* A Preliminary Discourse on the study of Natural Philosophy, page 133. Lardner's Cabinet Cyclopedia, 1831.

† The figures refer to specimens, intended for deposit in the Museum of the Society.—*Editor.*

such as to the right of the road from Madras to the Mount, just after passing Marmalong-bridge—also a mile farther up, close to the right bank of the river—near the little Mount—to the west of, and few yards from, the Race-Course—in which places the clusters of granite are intermixed with those of pegmatite (No. 2)—at the foot of Palaveram Hill, in one of which the granite contains garnets, in addition to the other minerals (No. 3)—and probably in many other places, which have not come under my observation.

In more than one locality, this granite loses the mica and becomes pegmatite, one of the granitic rocks most apt to decompose, forming white clay, or kaolin (No. 4); as may be seen at the western extremity of the Mount—along the right bank of the Adyar river, below Marmalong-bridge—between the native village, at the foot of the Mount, and the Race-Course; and in many other places.

Considering this superficial position of granite over the whole plain of Madras, it would seem more than probable that boring for water cannot be attended with success in any part of it.

Porphyritic boulders are not a rare occurrence in this plain, of which I have seen some between Guindy and Trimatoor, and at the foot of Palaveram. This porphyry is formed of well defined and separate crystals of white felspar, imbedded in a paste of the same mineral in the compact state (No. 5). Not a tract of hornblende, and very few plates of mica, are found in this porphyry.

In the little eminences of this plain, hornblende slate, occasionally passing into hornblende rock, overlays the fundamental rock; such is the case at the Mount, at Palaveram, etc. (No. 6).

The stratification of this rock is clearly seen in every place where it exists; many of the contorted strata being composed of coarse materials; others although having the same minerals, are in a more comminuted state, forming a finer grained stratum. In this rock the variety of proportions of the minerals composing it is endless; in some blocks we see strata of hornblende only; in others, of felspar and quartz, and, in others, of simple quartz; which last mineral occasionally intersects the strata at all angles, and in different directions, in very thick veins.

The huge masses of hornblende rock on the summits, or on the sides, of these hills, contain very little felspar, and having the appearance of being unstratified, the hornblende being foliated, shining and nearly black; in short it is the primitive greenstone, which is found all over India (No. 7). Its fracture is splintery, and the texture, like that of all green-stones, very tough and compact.

We must not omit mentioning in this place a rock which extends nearly over the whole plain (at least the eastern part of it), overlaying in many places the granite. I mean the conglomerate laterite, which

is observed in two different conditions, that of undisintegrated and that of a detritus.

The conglomerate laterite is seen, in its entire state, on the banks of the Adyar (where the blocks for the Break-water are quarried), overlaying the pegmatite—close to the Race-Course, going to the native village under the Mount, on a granitic block; and perhaps in other places (No. 8).

The detritus from this rock has two geological positions; the one as loose rounded pebbles, scattered all over the surface of the plain; the other as a substratum to the soil. This last has sometimes many feet thickness, imbedding occasionally undecomposed pieces of the compact conglomerate laterite, which proves that the detritus is derived from the present conglomerate (No. 9).

In more than one locality of this plain a stratum of nodular kankar is found between the lateritic detritus and the granite (No. 10). In some of these places (Guindy-garden near the Tank, south of the House) it is like earthy, friable, calcareous tufa, having pieces of granite imbedded in it (No. 11).

Trap is not unfrequently met with, either in loose blocks, or in dykes apparently of considerable dimensions. These last are to be seen between Palaveram and Trimatoor, where they are nearly level with the soil, or forming small swellings on the ground. Both the boulders and the dykes are composed chiefly of basaltic hornblende (No. 12). These dykes, as I have mentioned in another publication, are of a very frequent occurrence in India (*a*).

The surface of a portion of this plain, particularly near the sea, is sandy in some places, having minute grains of disintegrated garnets, which are derived from that mineral contained in the granite, and in the hornblende slate of the Hills about (No. 13).

Before finishing the geology of the plain of Madras, I must mention that in the clayey stratum, which, in some places inland, underlays the sand, marine organic exuviæ have been found, according to information I have received.

The investigation of the existence of these fossils is of the highest possible geological interest, and it would be doing the greatest service to science, if zealous individuals, resident in the Carnatic and along the Coromandel Coast, would collect specimens and facts on this subject, which is one of the *desiderata* in Indian geology.

Hitherto we have but few observations on the subject. Dr. Voysey was, I think, one of the first who mentioned the existence of marine and fresh water shells, in a fossil state, in the south of India (*b*). Colonel Cullen of the Madras Presidency deposited, as far back as 1822, in the

(*a*) Journal of the Asiatic Society of Bengal, August 1835, page 432.
(*b*) Journal of the Asiatic Society of Bengal, 1833.

Museum of the College of Madras, shell-limestone found by him at Paddapangallee in the Northern Circars, a few miles west of Rajamundry, and nearly forty miles from the sea shore, underlaying basalt. I was fortunate enough, in the year 1835, to visit one of those interesting hills in his company ; some oyster shells are well preserved in this limestone. Lately, Mr. Malcolmson of this Presidency, has given a more detailed account of the geological position of the fossil shells, found under the trap between Hyderabad and Nagpoor.

These geological appearances seem to countenance what is said in the Puranas, " that it has been handed down by tradition, that the " greatest part of the Coromandel Coast was suddenly elevated out of " the sea." (*a*)

Having given the foregoing cursory sketch of the geology of the environs of Madras, we may proceed to the description of the geological appearances of the places examined during the two Journies.

Allampaucum.—The monotonous plain, between Poonamalee and this place, offers nothing of any interest to the geologist, except the existence of a few straggling pieces of a chloritic slate, probably derived from some of the hills which are seen at some distance.

Near the Bungalow of Allampaucum the protruding rocks are composed of foliated felspar of a pale flesh colour, in some places decomposing, but not to such a degree as to form clay (No. 14). This felspathic rock occasionally imbeds angular pieces of white transparent quartz, and, *vice versa*, the quartz imbeds the felspar (No. 15).

The surface of the soil is bestrewed with a prodigious number of quartz pebbles, the angles of which are often worn down (No. 16). These pebbles originate in the disintegration of the huge veins of quartz, seen protruding through the soil, the imbedding felspathic rock having decayed.

These quartz veins are seen intersecting this rock close to the outlet of the large tank near the Bungalow, where is also observed the two minerals imbedding each other reciprocally. Not a few of these pebbles have their surface of a red color, which extends for some lines into their substance. It is the effect of the infiltration of oxide of iron *after* the disintegration of the vein, since the colour of the quartz in the rock is perfectly white and transparent (*b*).

Goriattum.—Approaching Goriattum the country loses the flat, tiresome appearance it hitherto had, and becomes hilly and pleasantly variegated with inequalities of the ground, and majestic arboreous vegetation in the ravines, and on the declivities of the hills.

(*a*) Heyne's Tracts, &c. But, curious enough, afterwards he adds, " but the appearances of the low lands renders it evident that the tradition cannot be correct !" page 1.

(*b*) I think it is what Buchanan call quartz impregnated with iron.—Vol. 1. page 31.

The greatest number of the projecting rocks, and of the rolled masses in the river close to the Bungalow, are granitic, both the common and the sienitic (No. 18).

As I was anxious to pass the eastern Ghauts by day-light (the party intending to pass in at night) I left Goriattum before them, and, as I thought, early enough to reach the Ghauts before sun-set.

Proceeding west, the country puts on a pleasing aspect, being interspersed with hills and vallies, which relieve both the mind and the eye from the wearisome sameness encountered before, and delights the inquiring traveller, offering objects of scientific interest.

Many hills and clustered masses of rock are seen in all directions; and on the convex sides of many of the former are placed saddle-shaped, immense cubic masses of rock, the remainder, and more depending portion, of the laminæ to which they belonged, having been hurled down into the plain. Others have these blocks, tor-like, on their summits.

Judging from the many rocks I examined near the road, all these hills are granitic, the rock being traversed by thick veins of quartz. Here and there in the plain I saw numerous pieces of quartzy magnetic iron ore, so common in the south of India; and in one place I saw an immense bed of it projecting above the soil.

Approaching Sautgur, numerous beds of a chloritic rock are seen, sometimes porphyritic; and in other masses, the minerals being distributed either in strata, or uniformly through the substance of the rock, it becomes a protogine (No. 19).

The clustered masses of rock in the plain, below the hills of Sautgur, are of sienitic granite (No. 20), intersected, as usual, by thick veins of quartz. When these veins happen to be found down the precipitous, naked face of a hill, and in a direction perpendicular to the horizon, the rock intervening between them decaying, these project above the vertical surface of the rock, which appears as if furrowed, or fluted. One of the hills of Sautgur has this appearance.

This sienitic granite, besides the hornblende intermixed with the other minerals, has nests of it formed of the pure foliated mineral, or in a granular state, with some pieces of compact felspar, so as to resemble hornblende porphyry (No. 21).

All the plain below these hills is bestrewed with numerous pieces of quartz and of foliated felspar, this last mineral being regularly crystalized, and its surface shining when seen at an angle with the light (No. 22).

On both sides of the road are seen, nearly level with the soil, the convex surfaces of large masses of a porphyritic rock, composed of regular crystals of red felspar, hornblende and a lively pistachio coloured substance—(chlorite ?) (No. 23).

The approach to Laulpet is exceedingly picturesque, on account of the many hills surrounding it, and the beautiful valley, so well cultivated with gardens, and fruit trees. The magnificent Mosque, close to the road, heightens the beauty of the scene, which receives no trifling additional ornament from the majestic Tamarind trees near the river.

The country, on both sides of the river, is alluvial and sandy, and after two or three miles it is interspersed with hills and knolls. On their summits, or sides, are seen rounded blocks, like logging stones ; and it is remarkable that this conformation obtains oftener on the hills to the right, than on those to the left, of the road. Does this appearance indicate a difference in the rocks of both sides ?

Having miscalculated my time, or lost more of it than I was aware of on the road, it was nearly sun-set when I reached the first little ridge which forms the beginning of the pass. This ridge is hardly two hundred feet above the level of the plain, and, in the section for the road, I could clearly see that the rock of which it is formed is sienitic granite (No. 24).

A torrent divides this little ridge from the high hill, up the steep acclivity of which the pass is cut. It was dark, and I was obliged in consequence to make use of torches, when I began the ascent, therefore I could see but little of the nature of the rocks forming this second hill. Yet on examining, afterwards, the specimens I had detached from the huge masses which had been blasted both on the floor and on the sides of the road, I found that this second hill, like the first, is formed of sienitic granite, with this slight difference, that, in some of the specimens from this last hill, there were a few plates of mica in addition to the other three minerals (No. 25).

Among them I found one which seems interesting, and the composition of which resembles an analogous rock found at Chinnapatam, to be described hereafter.

It resembles red porphyry, but it has nothing porphyritic in its structure, being composed of red foliated felspar—fracture rather shining—honey-combed with numerous small cavities, which are filled with a yellow substance, some of them having a micaceous, brilliant, metallic powder, strongly magnetic. In this specimen I saw no quartz which, however, is found in the rock of Chinnapatam, (No. 26).

Baitmungalum.---At this place we all were agreeably surprised and delighted, at being treated at breakfast with grapes, peaches and apples, of an exquisite flavour, the produce of the country about*—the climate being so mild, and the appearance of these European dainties on the table, carried us irresistibly, in imagination, to Europe, and me, in particular, to dear Italy.

* From Bangalore or Palamanair ?

After passing the eastern Ghauts, the rocks met with on the road to Baitmungalum are gneiss, the contorted strata of which are seen almost in every one of the blocks (No. 27).

This gneiss is similar to the same rock found in many other places in India, and, like it, has some of its strata almost exclusively formed of mica, with a few grains of quartz; and, in this last case, a hand specimen of it might be taken for mica slate (No. 28).

This last mineral (like hornblende in the sienitic granite) is occasionally contained in nests in this gneiss; and, mica being easily decomposed, it falls off, leaving small cavities on the surface of the rock, which are seen in many of the masses about Baitmungalum.

Going a mile or two west, and before coming to Golcondapatnam, the granitic blocks are scattered about all over the plain, particularly near the last mentioned village; they look like erratic blocks, and are easily recognized as granite by their appearance, different from those of gneiss, which have hardly any elevation above the soil, with a rounded convex surface; while the granitic clusters are more elevated and affect either a prismatic form, or are piled up one on the other like logging stones. Those close to Golcondapatnam, at the foot of which some batteries have been erected, have this last appearance.

In the dry bed of a river, before arriving at the last mentioned village, I saw a thick basaltic dyke, which stretched across the whole breadth of the river, its outgoings being split into rhombs, or parallelopipeds. This dyke appeared to have burst through the granite (No. 29).

Looking attentively to the numerous blocks of granite scattered about this plain, particularly those about a mile or two north of Golcondapatnam, the idea presents itself, almost involuntarily, to the mind, whether these masses are not erratic boulders, similar to those found in the plains of Sweden, Russia and northern Germany, and which, it is now ascertained, were derived from the Scandinavian mountains, very likely at the time of their elevation.

Brongniart (*a*) is of opinion that the boulders near Hyderabad are of the erratic kind, quoting the authority of De Luc (nephew); and, really, seeing on a level and perfectly horizontal plain (no hills of any magnitude being within many miles of them) these sometimes solitary, unconnected boulders, scattered in the most irregular manner, and, at others, heaped together confusedly in clusters and groups, the opinion of some geologists, regarding the erratic nature of these boulders in India, does not seem improbable.

This granite exfoliates in concentric laminæ of different thickness; nor are the causes producing this exfoliation confined to the mere sur-

(*a*) Tableau des Terrains, &c. page 83.

face, but they extend their action many inches into the substance of the rock, producing in consequence three, four or more laminæ, which, although having decided lines of demarcation, still adhere to the parent rock.

In this sienitic granite nests of green-stone porphyry are imbedded, as is the case almost in all localities in India, where this rock is found (No. 30). Their decomposition, and consequent falling off, accounts for the cavities we see occasionally on the surface of this rock, at the bottom of which it is not rare to find the remains of the old tenant (the nest of hornblende porphyry) still adhering undecomposed.

Proceeding west, towards Shamarpilly (just after leaving Golcondapatnam); to the left of, and close to, the road, is a little oblong knoll, or rather undulation of the ground, having at the top many blocks, different in colour and appearance from the granitic boulders just described. These are of a blackish colour, and covered with large patches of the all-pervading lichens (No. 30).

They are hornblende rock containing very little felspar—structure semi-foliated, and fracture glimmering. Numerous quartz veins intersect it irregularly and in all directions, some of them being nearly a foot thick. They are discernible from a distance on account of the contrast between their white colour and the black of the rock. In those masses in which the hornblende decays, they are seen projecting above the soil like beds of quartz rock.

The direction of this dyke-like bed of hornblende rock is N. and S. and its decomposition imparts to the soil in its vicinity a red ferruginous colour, different to that about Golcondapatnam, which is loose, white and sandy. The cause of this colour must be the oxide of iron, which appears to enter largely in the composition of the hornblende; since, like other primitive green-stones, it affects the magnetic needle.

Among the rocks, before reaching Bangalore, gneiss seems to predominate. It is composed of the usual minerals, forming regular strata conformable to each other, in some of which at one time the mica, and at others the quartz, predominates, sometimes to the exclusion of the other two minerals (No. 30). The quartz is white and transparent, the felspar of a paler hue, and the mica black.

Bangalore.—In the vicinity of Bangalore, gneiss is seen every where, having veins of quartz, or of foliated felspar, or of both together, traversing it. It seems to decompose, or to have decomposed, to a great depth, since we see the loam resulting from it very abundant all about Bangalore, and in some places having twenty, or more, feet depth; such is the case near the bazar behind the Barracks (No. 33). The clay that is found in this loamy soil is reckoned excellent for tiles, bricks, &c.

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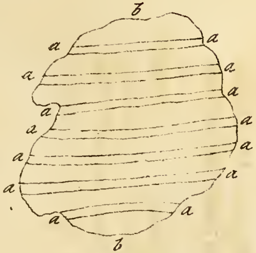
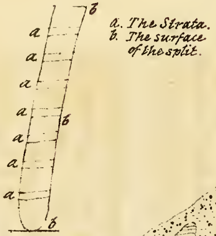
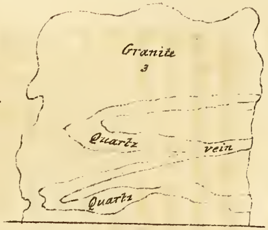


Nº 1. Front view of a lamina of gneiss exfoliated.



Nº 2. Profile of the same lamina

Nº 3.



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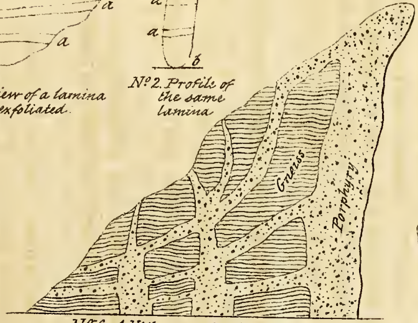

Nº 6. A Hill west of Sanklydroog.

Nº 4

Nº 5. South side of the Rock of Sanklydroog Fort.

Going towards the Fort or Pettah, a few yards before the cause-way, we see immense masses of gneiss, on the convex surface of which are thick veins of quartz and of felspar. In many of these veins, which contain both these minerals intermixed, the surface is sometimes honey-combed with numerous little cavities; an appearance which is owing to the decomposing and falling off of the felspar-pieces, leaving the places they occupied empty.

I must remark here a peculiarity in the structure of this gneiss; viz. that of splitting, both naturally and artificially, into laminæ, the direction of which is nearly perpendicular to that of the seams of the strata.

In fact, in the laminæ naturally detached from the rock, we observed that the strata are seen either horizontal, or vertical *on the surface* of them; therefore the laminæ exfoliate in a direction at angles with these strata.

We see in all stratified rocks that they generally split in the direction of the strata; so that the surfaces of separation shew only the surfaces of the seam. But, in the laminæ of this gneiss, the case is different; on the surfaces of the laminæ we see the strata, and their seams along *the surface* of the split, and therefore its direction is at an angle with that of the seams themselves. The annexed diagrams shew perhaps better than any words what is meant in the above remarks (Diagram, Nos. 1 and 2).

It appears that the natives have availed themselves of the peculiarity this gneiss has, of splitting in a direction opposite to that of the strata, to obtain laminæ of any thickness. The process to that effect is very simple and economical. On the convex surface of the gneiss they light a fire, the intensity of which is proportionate to the thickness of the slab to be obtained; and, after having kept it up for such a length of time, as experience has taught them necessary for the required thickness, they extinguish it, and pour cold water on the heated surface of the rock.

This sudden refrigeration producing an instantaneous contraction of the heated portion of the rock, extending as deep as the heat had penetrated, it is detached at that depth from the parent rock, and the lamina is easily removed, and cut in as many pieces as required.

The curvature of these laminæ being the segment of a very large circle, in the small dimensions they are generally cut they appear nearly straight, and are used for all architectural purposes, as columns, door-posts, steps, &c.

I have read, I do not recollect where, that the foregoing process is had recourse to, at Bangalore, to split granite. This must be a mis-statement, since at Bangalore, as well as in many other places in India, they use another, and very different, method to split granite, porphyry, green-stone, or other unstratified rocks.

This consists in making several square perforations, little more than an inch deep, with a hammer and a steel punch, in the rock, in a line, and in the direction they wish to have it split. This done, they put wedges in the holes, and strike on them with force, until the granite breaks (*a*). In fact, many of the granitic blocks about Bangalore bear the marks of this last process.

When this gneiss exfoliates naturally (like the blocks of granite), the decomposing causes act deep into its substance, detaching three or more laminæ at the same time. When I say that this gneiss exfoliates both naturally and artificially in laminæ, at an angle with the seams, I do not mean to exclude the possibility, nay the probability, of its often splitting in the direction of the seams. If my memory does not fail me, I think I saw this appearance in the two huge masses close to the nullah, which descends from the front of the barracks south. In the lower part of this nullah, going towards the bridge, the decomposition of the gneiss is clearly seen, perhaps more so than in any other locality about Bangalore.

On the western end of the Esplanade there are many blocks of granite, intersected as usual by numerous quartz veins, in the most fantastical way imaginable ; diagram No. 3 represents two of them.

Going west along the road parallel with, and close to the Barracks, a few hundred yards beyond them, there are some clay pits for bricks and tiles ; a fine tank, and a Mussulman burying ground are close to them ; the steps of the tank being constructed of gneiss, the stratification of which is quite evident.

At this place, turning to the left, we get into the road which leads to the Pettah ; for a little way all the rocks, right and left of the road, are granitic, split by numerous fissures both horizontally and vertically, so dividing the block into cubic masses (No. 34).

Proceeding a little farther on, in the field to the right, close to the road, masses of hornblende rock are seen protruding above the soil, in an uninterrupted continuation, with an east and west direction (No 35).

In this same field, flanking this bed of green-stone, are knolls and clusters of granite, through which, it would seem, the green-stone intruded. The thickness of the last mentioned rock, as far as its outgoings indicate, is seventy-two ordinary paces, the blocks extending, with hardly any interruption, for more than three hundred paces. Like many other primitive hornblende rocks, this affects the magnetic needle.

This dyke intersects the road extending a little way in the field to the left ; it contains very little felspar, which in some of the masses

(*a*) See Buchanan's Journey, vol. I, page 133.

being totally wanting, the rock then assumes the aspect of basaltic hornblende. This rock, when decomposed, forms a red ferruginous soil.

About three hundred paces beyond the western extremity of this green-stone, there are some clusters of granitic blocks, some placed, tor-like, one upon the other. On examining one of them, I saw a basaltic dyke, traversing it in an east and west direction, having entered the block from the west; since its thickness on that side is about five inches, and getting thinner as it advances east, it is finally lost in the substance of the granite (No. 36).

Guided by induction, I surmised that probably the dyke, before reaching this block, may have traversed those that were seen about fifty paces west of the first cluster, in which case the trap must have a greater thickness than in this, where it appears the dyke spent itself. My conjecture proved correct, since I saw two distinct dykes of basalt traversing, in all their length, two granitic blocks in this second cluster (No. 37), and of greater dimensions than that in the first rock.

These second masses of granite are not so large, nor so prominent above the soil, as the former ones. They are hardly three feet above the ground, and extend about sixteen in length. In one of them I saw a dyke of very compact basalt, the fracture of which is dull and its texture extremely tough. It has an uniform thickness, all its length, of about three feet, stretching the whole length of the rock. The surface of this basalt was divided into rhomboidal pieces.

In the other block of granite there is a second dyke of smaller dimensions, and only a few feet from the former. The mass, through which this second dyke passes, seems to have suffered displacement from two splits, which rent it into three pieces, displacing the middle one and causing a fault in the dyke; the diagram No. 4 represents this fault. Both these dykes converge one foot in ten paces.

The granite in contact with the basalt appears to have lost its crystalline structure, and become more friable than the same rock at a distance from the trap. I would have pursued the examination of this dyke further west, but seeing no projecting rocks in that direction, the examination could not be followed up.

I do not recollect to have ever seen in India the gneiss so well characterised, and its strata so much contorted, as in the locality I am going to point out. North of, and near, the European cavalry barracks, there is an extensive tank, the waters of which are confined, on the east side, by an embankment. About the middle of this rises a huge rock, or rather hillock, about 100 feet above the level of the plain, formed of gneiss, the strata of which, as I said, are contorted in the most striking manner (No. 38).

The whole mass of this gneiss has the usual convex surface, and

exfoliates in thick laminæ, portions of which lay, like huge cubic pieces, on the convexity of the rock. The quartz strata of this gneiss are seen sometimes protruding some inches above the surface of the rock, for the reason so often mentioned in the course of these Notes; here, as elsewhere, the gneiss contains nests of mica.

Chinnapatam.—Along the road near Kingairee and Closepet, hornblende slate is the rock jutting above the soil (No. 39). The village of Chinnapatam is situated in a plain, and being surrounded by a dry ditch some feet deep, an opportunity is given of seeing the rock which underlies the soil.

In this ditch the lowest rock is gneiss, in many blocks the felspar being of a flesh colour (No. 40). This mineral, also, in veins, intersects the strata of the gneiss, the surfaces of contact being tinged with a green substance (chlorite ?) (No. 41). The stratification of the rock is clearly seen in the walls of the ditch, where it is in a decomposing state.

The greater number of stones of the walls which surround the village, the gate of the Fort, the several works, the door-posts and steps, are all of this gneiss.

On the outside of these walls, which are constructed without cement, I found some pieces of a rock, which I am at a loss what to denominate. In the few blocks I saw in the walls, the rock seemed unstratified, having a porphyritic appearance. It is composed of red semi-foliated felspar, approaching to compact, and glittering—penetrated by numerous microscopic cavities, occasionally filled with a yellow clay, and containing grains of perfectly transparent white quartz, some of them in regular crystals of that mineral (No. 42).

I was inclined to call it porphyry, but, having lately examined other specimens from the same locality, in which the stratification of the rock is quite evident, I forbear giving a name to it *(a)*.

Mundium.—All the rocks between Chinnapatam and Mundium, and for some miles round, are hornblende slate, intersected in all directions by numerous quartz veins, of divers dimensions and shapes. The soil about the Bungalow is bestrewed with quartz stones and pebbles, chiefly angular, resulting from the breaking up of the quartz veins of the hornblende slate.

In the vicinity of Mundium I picked up some loose pieces of talc-slate, mica slate, actynolite slate, indurated asbestos, green-stone, &c. (No. 41).

(a) Since my examination of this rock I have read Mr. Hardy's remarks on the geology of the country in the route from Baroda to Udayopoor, &c. where he describes apparently on analogous rock, but his is stratified, and he classes it among the varieties of granite.

Seringapatam.—As we remained but a few hours at Seringapatam, my geological observations of that place were very cursory; therefore what I am going to say of its geological features, is the result of the desultory examination of a very confined spot. The localities I visited were the ditch which surrounds the Fort, and the bed of the Cavery.

On entering the Fort by the southern gate, and descending in the dry ditch below the bridge, I remarked the following appearances. The walls of the ditch show a stratified rock in a decomposed state; it is gneiss, abounding with mica, which forms, often exclusively, entire strata, as is the case at Baitmungalum, Bangalore, &c. (No. 44).

Proceeding west along the ditch, towards the Mysore gate, we meet with thick beds of a silicious slate, traversing the gneiss at different places and in all directions. It is probably what Buchanan calls hornstone as found about this place, and in the island of Seringapatam, called by the natives *madi-culla (a.)* No. 45.

The strata of this silicious slate have many feet thickness, and are traversed in all directions by numerous, almost imperceptible, fissures, in the direction of which the rock, when struck, often splits, showing on both surfaces of the separation beautiful, superficial, dendritical appearances, like those occasionally seen in the alpine limestone, and in some novaculites (hones) of the clay-slate formation, produced by the infiltration, through the fissure, of the oxide of manganese, at least as far as it regards the limestone.

This silicious schist, besides intersecting, as veins, the gneiss, overlays it in some places, as is seen, on entering the Fort by the Mysore gate, to the right, where it lays in large tabular masses over the gneiss.

A little farther on, going always west, we see masses of hornblende rock, overlaying the two rocks just described. This green-stone, both as blocks and as dykes, I had seen soon after descending into the ditch below the bridge (No. 46).

This hornblende rock hardly contains any felspar, and it is evidently unstratified—sonorous when struck—of glimmering fracture—and of a black colour. The elegant columns of Hyder's and Tippoo's Mausoleum, beyond Shahar Ganjam in the Island, are of this rock, which however was brought from a different place, as Buchanan informs us, viz. from Cuddahully near Turivicary, about 52 miles from, and N.E. of, Seringapatam, and called by the natives *Carricullu*, or black stone *(b)*.

Some of the masses of this hornblende rock have a variolated surface, which, however, on breaking the stone, does not *seem* to extend into the interior of the rock. I say *seem*, because, polishing on the

(a) Buchanan's Journey, vol I. page 133.
(b) *Ibid.* vol. II. page 61.

stone, the rounded marks re-appear and of a deeper colour than that of the rock itself.

Buchanan took particular notice of these darker spots in the polished rock, and attributed them to the crystals of basaltine *(a)* (so was augite called at the time he wrote) imbedded in the hornblende; in which conjecture I think him perfectly correct, as the mineral is augite which gives the described appearance to the rock, and it is seen clearly marked in the above mentioned columns of Hyder's Mausoleum.

It must be remarked that the veins of the silicious schist, intersecting the gneiss up to its surface, do not penetrate into the overlaying greenstone, showing the posteriority in age of the last mentioned rock.

In going out of the Fort through the northern sallyport, close to which Tippoo was killed, you come upon the right bank of the Cavery, which washes the walls of the Fort at this place. When I visited Seringapatam (March 1834) there being very little water in the river, all the rocks forming its beds were exposed to view, enabling me to judge of their nature.

The principal rock in it, is gneiss, which appears to extend along the course of this river for a considerable distance; since I have met with the same rock, jutting above the waters of the same river, at the ferry of Polleapoliam, nearly 100 miles S. E. of Seringapatam. This is one among the many proofs that gneiss is the universal subjacent rock in the table land of Mysore.

Mounting some of the masses close to the outside sallyport, you stand on blocks of a beautiful porphyry of red colour. This rock cuts the gneiss in the bed of the river in an oblique direction N. E. and S. W. across its whole breadth, and is seen continued on the opposite bank, a little below the northern extremity of Wellesley-bridge.

This porphyry (No. 47) is composed of well defined crystals of red felspar, which occasionally are white, imbedded in a paste of compact felspar of the same colour. Besides these two minerals it contains tourmaline, in numerous needle-shaped crystals distributed through the rock, without having any common direction. The red colour of this porphyritic dyke, through the grey of the gneiss, points it out even from a distance.

Among the numerous pieces of rock, scattered about the western side of the Fort, are found some of a stratified rock of a porphyritic appearance, composed of red felspar, imbedding pieces of white transparent quartz, and having thin veins of beautiful pistachio-coloured actynolite (No. 48).

Just below the southern extremity of Wellesley-bridge, along the right bank of the Cavery, I noticed an enormous accumulation of a friable calcarious tufa, somewhat resembling *osteocolla*, or those calcari-

(a) Buchanan's Journey, vol. II. page 61.

ous incrustations enveloping vegetable substances, when placed in the course of waters abounding with carbonate of lime (No. 49). Many pieces were analogous to the nodular kankar found in the plains of India. From what I shall mention hereafter, it appears that some of the tributary torrents to the Cavery contain a good deal of carbonate of lime.

The hill of Mysore I could not visit, but judging from some specimens I have seen from it, it is formed of granite composed of white and rose coloured quartz, white felspar, black mica and a few garnets (No. 50).

Nunjengode.—Close to Nunjengode flows one of the branches of the Cavery, over which a bridge of fifty-five arches is thrown, and in this place many torrents discharge their waters into it. One of these rivulets appears to have its waters overcharged with carbonate of lime, which is deposited all along its course, from its junction with the Cavery upwards.

Over this torrent, where the road crosses it, there is a small bridge, below which the high banks of the torrent are entirely formed of calcareous tufa (No. 51). In this spot the deposit is so white, so spongy and light, that it might be taken for pumice.

A few yards above the bridge of this rivulet we see on both its banks a stratified rock ; it is chlorite slate (No. 52) ; its fracture being dull and earthy, and intersected in an irregular manner by veins of different thickness, both of white quartz and of red felspar, which, with the green of the chlorite, form a very elegant looking stone (No. 53). The red felspar veins, however, do not occur so frequently.

Among the seams of this chlorite slate, the same kind of calcareous tufa is deposited, which not only penetrates for some lines into the seams, but also projects some lines, and even inches, beyond the surface of the rock, like fungous, or mammillated, excrescences.

As the strata of the chlorite slate are not in perfect coaptation, the seams gape a little, and the carbonate of lime insinuates itself pretty far into them, so that when the projecting blistered portion of the calcarious deposition is broken off, a thin stratum of kankar is seen between the strata of the slate, and might be taken as an inter-stratification with them. But, by examination it is soon seen, that this calcarious infiltration does not penetrate beyond a few lines.

Besides this new kind of kankar, I found, jutting from the soil or loose on the surface, large pieces of the ancient kankar (No. 54), which is very different from the modern, being more compact, semi-crystalline and sparry in the fracture, and concretionary in its structure ; in short, very much resembling the ancient *travertino* of Italy.

All the blocks along both sides of the Cavery, and projecting above

the water, are hornblende rock, with thick veins of quartz, which seems also to be the prevailing rock all over the plain.

Goondlapet.—This is a walled village, with a dry ditch round it, which gives an opportunity of examining the rocks below the soil, while the different kinds of stones, employed in the construction of the walls, show those which prevail in this neighbourhood.

Many of them have a stratified appearance, in which the prevailing mineral is actynolite, with hornblende and a flesh coloured felspar (No. 55). In the walls I also found many blocks of a very crystalline sand-stone, and some of quartz rock (No. 56); there are stones of a beautiful chloritic porphyry (No. 57), some of green-stone, of gneiss, of granite, &c.

All these stones must have been brought from some distance, since the only rock about the place, *in situ*, is the actynolite schist, to be seen in the lower parts and floor of the ditch, and in the streets of the village (No. 58). This schist has strata of quartz, conformable to those of the slate.

Between the western wall, and the houses of the village, the actynolite schist is coated with a thick deposition of ancient kankar, as hard as the old travertino, although its texture is not so crystalline. It is composed of a calcarious paste of a grey colour, imbedding chiefly angular, or slightly rounded, pieces of a reddish limestone, besides pieces of quartz, actynolite slate, hornblende, felspar, talc, &c. In short it forms a real breccia.

Besides incrusting the schist, this ancient kankar is seen in large isolated pieces implanted in the soil, and in the streets of the village.

Goodloor.—Goodloor stands at the commencement of the ascent to the Neilgherries, at the foot of a very high hill of the Wynaad group. The blocks all about the village are sienitic granite.

End of the first Journey.

Second Journey.—The geological appearances of the country, between Madras and Allampaucum, having been described in the foregoing pages, I shall begin the notes of the second journey from the last mentioned place, whence we diverged towards the south.

Leaving Allampaucum, and proceeding west, the blocks, on both sides of the road for some miles, are of foliated felspar with very little quartz (No. 59).

As we approach Arcot these masses in the plain are granite, and we are informed by Buchanan that the hills about Arcot and Vellore are granite (*a*) (No. 60).

(*a*) Journey vol. I. page 17.

Judging from the numerous blocks of basalt, loose, and protruding through the soil, and with which the water courses (where they intersect the road) are paved, trap must be abundant in this vicinity, either as dykes or as an overlaying rock (No. 61). Nevertheless, with the assistance of a powerful telescope, I could not distinguish any different coloured rock, either at the summit, or on the sides, of these hills.

On approaching Arcot, the first hills we see have the appearance, characteristic of many others in the plains of India. They shoot up in a conical form from the horizontal plain, and have the appearance of a cone placed on a table. No talus round them, no rising ground, no inequalities in the soil above them, but the line of demarcation, between the foot of the hill and the plain, is sudden and decided. This appearance is the same, when the hill has a ridgy form instead of the conical.

The hills which succeed these have a different aspect—the first, being granitic, have sharp outlines and a barren naked appearance; the latter are rounded, with very few rocks projecting, and are covered with thick vegetation. Close to the road I saw some boulders of a chloritic stratified rock, similar to that near Sautgur.

Palliconda.—This village is beautifully situated near the confluence of two branches of the Pallar river. West of, and within a mile from, the Bungalow of this place there is a ridgy hill with a N. and S. direction, which, in my opinion, is very interesting in a geological point of view.

In the year 1834, while halting at this place, I made an attempt to ascend this hill, but I was baffled, on account of the many difficulties I met at the place where I endeavoured to scale it (about the middle of the ridge).

This second time, however, having taken a good guide, I started for the summit, south of the ridge on which the pigmy Pagoda, dedicated to Chillima Kali, stands—and, although I succeeded in reaching it, I underwent more fatigue than I had anticipated.

There is neither road, nor even a foot path up to the summit, and the guide led me scrambling along the furrows of small water courses, as the only places which afforded a penetrable passage through the dense shrubby jungle, rendered almost impassable by the thick and tall tufts of the lemon grass.

This ascent caused me more fatigue than I ever experienced, even in ascending the summit of Vesuvius, for here I toiled an hour and an half to reach the Pagoda, and there I was on the brim of the crater in three quarters of an hour.

I was quite exhausted when I reached the huge mass on which the Pagoda is erected. The blocks of rock, in this place, are heaped up in the greatest confusion imaginable, having betwixt them terrific chasms,

over which you must leap to reach the Pagoda; and, in the weary state I was, it was rather a nervous feat to leap over an abyss yawning under the feet.

The view, however, from the summit more than repaid me for the labour I had undergone. The whole plain, for many miles on both sides of the rivers, was partitioned into thousands of fields regularly laid out like the beds of a garden, or park, presenting a most lively green expanse, which, carpet-like, was spread out over the plain. It was the new grain, growing luxuriantly in all places, that gave this lively appearance, while the rivers (then become one) were rolling their waters majestically through the plain which they rendered so fruitful.

The village of Palliconda itself is a striking object, in the midst of so much industry and fertility, but my eyes were wandering about in vain to find the habitations of the thousands, for whom Providence had so bountifully provided, and whose exertions produced so much fertility—Palliconda excepted, I saw no other village, or hamlet, in that plain.

Sitting on the pinnacle of the highest mass (higher than that of the Pagoda), I rested myself, admiring the magnificent prospect under me—I wished to enter the Pagoda, but a chasm intervened, which I would not venture to stride over, being on the brink of a precipice, the vicinity of which makes at all times giddy.

The rocks of which this hill is formed are very interesting to the geologist, as offering a luminous proof and example, how necessary and just is the distinction between *sienite*, properly so called, and *sienitic granite ;* the former generally associated with eurite, porphyry, basalt and other trap rocks, and, therefore, differing in geological position, and posterior in age to the latter, which, although resulting from the aggregation of the same three minerals, is associated with primitive rocks, in primitive countries.

It was Dr. Macculloch, in his masterly description of the geological features of Glen Tilt, who first shewed that, besides the sienite associated with trap, there is a rock, having the same composition and aspect, but of a different age, being in an older geological position. The specimen, which served as a type for his nomenclature, was brought from the neighbourhood of Dresden, where the sienite is associated with porphyry and other trap rocks. Werner, seeing that the Dresden rock contained the same minerals as that of which some of the Egyptian sculptured works are formed, called it *sienite*, from *Siene* in Upper Egypt, where the material was quarried. Accurate observation proved to Macculloch that, besides the sienite so called by Werner, which is an overlaying rock of a posterior origin to granite, there was one in Glen Tilt, which, although composed of the same minerals, was associated and contemporaneous with primary rocks: in short that there was a

granite of primary formation, which contained hornblende instead of mica. By reasoning of this strictly scientific character, to avoid confusion, he proposed the term *sienitic granite* for the primary rock, reserving that of *sienite* for the overlaying rock, which is associated with porphyries.

As far back as 1813, Brongniart, in his classification of rocks, admitted the *sienite granitoïde*, which is synonimous with sienitic granite. Humboldt, in his *Essai geognostique sur le Gisement des Roches*, not only recognized the essential difference of the two rocks (the one an overlaying rock of posterior origin to the other, which he clearly states to be a true primary granite, with hornblende instead of mica), but he was the first to point out the mistake of Werner, who thought the Dresden rock to have the same geological position as that of Egypt.

From Europe let us pass to the writers of this country. Voysey adopted the name of sienitic granite in the same sense as the proposer of the term. Mr. Hardy (see his geology of Udayapoor) writes as follows : " the granite there is the true granite, viz. quartz, felspar and mica ; sometimes this last is wanting, and then it passes into pegmatite, and then into sienitic granite ; then into hornblende rock, some kinds of which resemble the green-stones of the trap formation."

This limited signification of the term sienite is perfectly correct, when applied to the rocks in some of the localities of southern India; the rock being there often associated with porphyries, as I have had more than one opportunity of observing at Tripatoor, Pallicondah, &c. where porphyry and eurite accompany it.

Many of the blocks scattered in the plains, between the foot of the hill and the Bungalow, are sienitic porphyry (No. 62), having well defined crystals of felspar, imbedded in a paste of hornblende, differing in this from the porphyry of Tripatoor (to be described hereafter), the paste of which is compact felspar.

Level with the soil, and near the skirts of the hills, there are numerous outgoings of basaltic dykes, decomposing in concentric layers (No. 63).

Proceeding to the foot of the hill the sienitic porphyry assumes the structure of true sienite (No. 64), that is, an uniform mixture of hornblende, felspar and quartz, not in regular crystals, which both in Europe and in America is associated with basalt, eurite and other trap rocks; this is also the case with this rock of Palliconda. As we ascend the hill we see the same rock, sometimes with a porphyritic, and at others with a granitic, structure. Indeed the transition between these two appearances is quite insensible, and often seen in the same block.

Dykes of basalt are found traversing this sienite, their direction being (at least of all I examined there, more than six in number) uniformly

that of the ridge itself, that is nearly N. and S. This of course must be understood of their trunks, because the ramifications had no particular common direction, but shot from their sides at different angles (No. 65).

This sienite, at the points of contact with the basalt, and for some inches in its vicinity, acquires a greater degree of hardness, the felspar assuming the appearance of the compact variety ; while in the same block, at a distance from the basaltic dyke, the sienite is in a friable decayed state ; the same changes in compactness occur in those pieces of rock which are entangled in the trap. In the sienitic porphyry it is not rare to find some veins of chlorite (No. 66).

On arriving at the foot of the masses below the Pagoda, a bed of an euritic rock is met with, seemingly in tabular masses, jutting through the sienite. It is of the same composition and structure as the blocks placed, mantle-shaped, on the declivity of the ridge further north, where it also appears to form the summit of the hill.

In appearance, this euritic rock resembles the silicious schist of Seringapatam, but I saw no fissures, nor dendritical infiltrations, in this rock. The smaller pieces of this eurite assume a prismatic form, well defined.

The huge masses at the summit are of a very hard, tough and compact sienite, its felspar being of a pale brownish colour, which, together with the black of the hornblende, gives to the rock a greyish appearance (No. 67). The soil resulting from the decomposition of this sienite is clayey, crumbling when dry, not tenacious, and of a grey colour.

Tripatoor.—About three miles from, and east of, the Bungalow of Tripatoor, there is a hill in the form of a ridge running N. and S. that is precisely in the same direction as that of Palliconda, which last seems to be a continuation of this of Tripatoor, having probably been erupted by the same convulsion, at the same remote period, and through the same fissure in the crust of our planet. It rises abruptly from the plain, having, in all its length, uniformly the same height, about eight or nine hundred feet above the plain. Its sides are steep, stony, and overgrown with thick bushes and a few trees. The only part I examined was about three miles along the foot of the south side.

Over the whole plain, before reaching the hill, were scattered loose masses and pieces of a porphyritic rock, which appears to form the entire hill. On arriving at its foot, we see nothing but porphyry, with an occasional block of sienite.

This porphyry (No. 68) is composed of regularly formed crystals, in general of a pale flesh colour, but, not unfrequently, they are white, imbedded in a paste of compact felspar, of the same colour as the crystallized mineral ; so that the rock has an uniform hue.

These masses of porphyry, which are near the sienite (to be describ-

ed hereafter), having an intermixture of a little hornblende, are somewhat similar to those of Palliconda.

On the surface of some of these porphyritic masses, the crystals of felspar are more than an inch long, and project a little above the surface of the rock, on account of the partial decay of the imbedding paste. In the blocks of the porphyry which are near the sienite, there are nests of hornblende, and then the porphyry in contact with it has a reddish tint, probably from being penetrated by a little oxide of iron of the hornblende; of this porphyry the large blocks have a rounded form, the small ones are prismatic, pyramidal, &c.

Judging from the colour and appearance of the masses on the summit of the ridge, they are also porphyritic.

Proceeding eastwardly, about two miles along the foot of the hill, we meet two hillocks formed of sienite (No. 69), analogous to that of Palliconda, and having, like it, some thin veins, or grains, of chlorite.

In both these rocks I remarked many fissures, of which the direction is invariably perpendicular, never parallel, to the horizon, so that they assume prismatic, pyramidal, columnar, or spheroidal, forms. This sienite decomposes into a red soil.

Returning to the Bungalow, about half a mile from the foot of the hill, I saw jutting out from the soil, three or four large oblong masses, only a few feet above the ground, of a rock rather interesting, and rarely met with in India (No. 70).

It belongs to the endless varieties of the hornblende rocks, which, Proteus-like, change appearance and composition in every locality in this part of India. It is of a black colour—texture loose and friable—traversed by veins of quartz and of felspar. It is composed of bottle-green hornblende, intimately mixed with nearly the same quantity of black mica, in a greater state of hardness than usual. I think it is the same rock mentioned by the late Dr. Turnbull Christie, as found with numerous other varieties of hornblende rock, at the stupendous falls of Garsipa (*a*).

It is to be remarked that the portion of the rock, in contact with the felspathic or quartzy veins loses its colour, becoming of a light green, and powdery. Basaltic boulders are not rare in this plain.

The three rocks, already described as found near Tripatoor, are evidently unstratified; and, judging from the desultory examination of a small portion of the hill, it would seem that the porphyry overlays the sienite. It would be desirable that a thorough examination should be made by some geologist, who could devote a few days to the geological survey of this interesting mountain ridge.

Gneiss appears to underlay these three rocks already described—

(*a*) Edinburgh New Philosophical Journal, 1829, p. 8.

abounding with mica, of which alone some of the strata are exclusively formed. The outgoings of some are seen below the tank near the Bungalow, where the usual contortions in the strata of this rock are strongly marked (No. 71).

Adamancotta.—All the plain, in the vicinity of the Bungalow, and as far as the Cavery, has numerous quartz pebbles, some angular, and others rounded, which proceed, as every where else in the south of India, from the decomposition of hornblende slate (which is the surface rock at this place), and consequent disintegration of the quartz veins invariably intersecting it (No. 72).

The stratification in the rock here is well and clearly developed, the minerals composing it occasionally alternating in separate strata; so forming what might be called sienitic gneiss.

It is not an unfrequent occurrence in this schistous diorite to find some of the strata composed of two minerals only, to the entire exclusion of the hornblende; the felspar and quartz being regular crystals. In this case the rock assumes a pegmatitic composition, and, like that rock, decomposes into kaoline (No. 73).

Loose pieces of quartzy magnetic iron ore are frequently met with in the plain, but I was not fortunate enough to find any corundum, which, I have been informed, exists in this neighbourhood.

Salem.—The whole tract of country, between Adamancotta and Salem, is hilly, and full of inequalities, on account of the many branches and spurs, proceeding from the Shevaroy-hills, which intersect it in all directions.

The composition of the rock forming these hills is the same as that of those they are the prolongation of, that is, hornblende slate. I do not recollect to have seen the stratification of this rock any where in India (Mookoorty Peak excepted) better marked than in the hills through which the new Pass has been constructed, where the sections for the road shew it clearly, and also in the beds of small rivers near it (No. 74).

As in many other places in India, this schistous diorite near Salem, contains thick veins of quartz, which, protruding above the soil, form small knolls and ridges, which may be taken for a quartz rock formation; the general dip of the strata of this slate is west.

As we were to pass Salem by night, and the magnesite formation being situated only five miles before reaching that place, I should have been sadly disappointed, had I to proceed with the whole party, and to pass through it without seeing this interesting spot; so I had it arranged that, as soon as my Palanquin arrived at the place where the chunam is found (they call the magnesite so, thinking it lime), the

bearers should halt in the road till day-light, to enable me to satisfy my wishes, and then join the party at MacDonald's choultry.

I reached the magnesite at midnight, and remained in the road till day-light, when I got up and began my examination. About five miles N. W. of Salem, the schistous diorite, which we have seen forming all the hills in this neighbourhood, is intersected by numerous veins of magnesite, of different thickness, and crossing each other in all directions, so as to make an intricate net-work in the rock (No. 79).

The masses containing the magnesite have hardly any elevation above the soil, and the area, occupied by this formation, may have about fifteen miles circumference, the surface being undulated with a few knolls and nullahs.

Nearly all the veins of magnesite are vertical, and the only ones I saw in an horizontal position were those in the banks of the nullahs. These veins vary in thickness from a few lines to three or four inches, and they are not uniform in their dimensions, sometimes thinning, and at others thickening, along their course.

Generally speaking the rock intersected by the magnesite is decomposed into an ophitic stone (No. 80), sometimes quite friable and powdery; at others it resembles decomposed wacke (No. 81). Those masses of hornblende slate which have either very little magnesite or none at all, maintain their crystalline structure. In more than one block, between the magnesitic veins and the rock, I found thin veins of asbestos, of an indurated earthy structure, and in some other masses, instead of it, talc slate and nephrite (No. 82).

The outgoings of these magnesitic veins, in general, are rough and bristled with numerous sharp points; but many others, particularly the loose pieces, have a mammillated, botryoidal, or cauliflower-like, surface. In more than one of these last mentioned pieces the surface is excavated by little furrows (No. 83). These veins are nearly all formed of simple magnesite; there are, however, some in which the magnesite is contained in a breccioide mixture, its angular pieces being imbedded in a pale red kind of cement (No. 84).

This magnesite is extremely heavy and compact, so as to strike fire with a hammer; of course I mean the most compact kind. Its fracture is semi-conchoidal, earthy, and has the dull waxy appearance of some of the varieties of the alpine lime-stone, except that it possesses greater whiteness. It effervesces slightly with acids.

This mineral attracted the attention of European gentlemen, who first visited the place, particularly Dr. MacLeod, and others, who accurately examined and analyzed the magnesite, and made numerous experiments, not only regarding its medical qualities, but also as to its utility as a cement, particularly for works constructed under water.

Judging from the few trials I witnessed at Madras with the magne-

site for the purposes of architecture, I think it one of the best materials I have ever seen or heard of ; perhaps equal, if not superior, to the cement made with lime and puzzolana.

For its analysis I must refer to Dr. MacLeod's report to Government, which I am told contains the most accurate description of this magnesite (*a*).

After calcination it absorbs water with great avidity, and forms, even by itself, a hard cement ; but, if mixed with a due proportion of sand, it makes a marble-like cement, which, by what I have seen of the well-conducted experiments and trials of Col. Monteith, is by far superior to all those I have seen, Parker's not excepted.

By the description we have of the magnesites found in various parts of Europe, this of Salem differs from them all in its geological position, and in its composition.

As, among the European magnesites, there are some effervescing and others plastic, probably none of them possessing both qualities at the same time, Brongniart classed them under two species, the effervescing and the plastic. This of Salem seems to differ, then, from them in this respect, being both effervescing and plastic.

It differs also in its *gisement,* since those near Madrid, Paris, Salinelle, in Moravia, Piedmont, Elba, Silesia and Styria, are all imbedded in rocks of secondary formation, and generally associated with limestones and silicious minerals, such as chalcedony, chert, jasper, opal, &c. while the Salem mineral contains none of these (*a*), and is imbedded in a primary stratified rock. The only magnesite which in Europe appears to approach to the age of this of Salem, is that near Turin, which is imbedded in serpentine.

I am informed that in another locality, Yedichicolum near Trichinopoly, close to the Cavery, there is another, and more extensive formation of magnesite, which contains, besides the minerals above enumerated, chromate of iron ; I could not find a trace of this iron in the formation of Salem (*a*), but it must be remembered that I only examined a very small space of the large area that it occupies.

This second formation of magnesite, besides the additional advantage that could be obtained from the chromate of iron, and from the circumstance of its being near a navigable river, has the quality of being more easily calcined than this of Salem.

The Shevaroy-hills, and those either near or connected with them, are all of hornblende slate, and this formation seems to extend for some miles west (No. 85).

About five miles W. of Salem, in the nullahs, ravines and beds of torrents, we see masses of gneiss (No. 86), which is the principal un-

(*a*) See Note at the end of this Journal—*Editor.*

derlaying rock in all this district. Some of the projecting rocks assume the appearance of mica slate, for the reason so often mentioned.

Proceeding towards MacDonald's choultry, we see some small ridges of white quartz rock, which are distinguishable even from a distance, on account of their colour, different from the greyish hue of the gneiss, and the black of the hornblende slate. They are the outgoings of the beds of quartz in the gneiss (No. 87).

Although the last mentioned rock is seen as subjacent to the hornblende slate, still the diorite continues to form all the hillocks and eminences, on both sides of the road. This rock is clearly seen, eight miles west of MacDonald's choultry, as a subordinate rock to the gneiss, in a deep nullah near Conjamallee hill, where the gneiss occupies the lowest situation in it, while the green-stone slate forms the whole hill.

The hornblende slate formation terminates, or at least is interrupted, about ten miles west of MacDonald's choultry, and is succeeded by a granitic rock, or, more properly, by protogine, containing, besides felspar and quartz, some plates of talc (No. 88). They say that in this rock occasionally aqua-marine is found.

By far the greatest number of the masses along the road are porphyritic in structure, or real porphyritic granite; but in those blocks, in which the mica is disseminated uniformly through the rock, and the felspar in granular pieces, it assumes the aspect of granite (No. 89).

For miles before reaching Sanklydroog, we clearly see that the hills we are approaching, are of a different formation to those we have just left; to the tame, rounded, blackish outlines of the hornblende hills, covered with thick, shrubby, and arboreous vegetation, we see succeed the abrupt, precipitous, naked and whitish appearance of those we are approaching.

Sanklydroog.—In all the neighbourhood of Sanklydroog, the elevated places, such as hillocks and rocky clusters, are of the porphyry we are going to describe; but in the ravines, nullahs, water-courses, and, in general, in the plains, the protruding rock is gneiss (No. 90). It forms the lower skirts of many of the hills east of the Fort; and even in the declivities of some of them, the gneiss is seen traversed by veins or dykes of porphyry. In this gneiss the mica in strata is as frequent, as in the places often mentioned in these Notes.

This porphyry is composed of large crystals of pale flesh-coloured felspar, imbedded in a paste of the same mineral in the compact state, and of the same colour as that of the crystals. Some of the masses have hardly any imbedding material, but are an assemblage of fragments of crystals confusedly mixed together. This rock contains neither mica nor quartz (No. 91).

From the Bungalow, going to the only accessible side of the rock, all the blocks fixed in the soil are gneiss. In the enormous masses forming the rock, this gneiss is entangled often in the thick veins of porphyry, which burst up through this primary stratified rock; the diagram No. 5, represents this striking intrusion of the porphyry through the gneiss.

Owing to the contrast between the colour of the traversing, and of the traversed, rock, these porphyry dykes are seen even from a distance; diagram No. 6, represents a hill, not two miles west of the Bungalow, seen through a powerful telescope.

Polliapolliam.—The country between Sanklydroog and Polliapolliam is level; and the whole of the protruding rocks, gneiss, which forms the bed of the Cavery at this place, all the masses jutting in the river being of that rock, analogous to the gneiss forming the bed of the same river at Seringapatam (No. 92).

Avanashy.—The rocks seen in the nullah near the magnificent Pagoda, celebrated for its sanctity, close to the Bungalow are of a stratified rock; quartz being almost the only mineral forming it, with very little hornblende and felspar.

It is, undoubtedly, one of those immense veins of quartz which traverse the hornblende slate formation; an anomaly in composition, which sometimes happens in the same rock, when another of the minerals composing it, the hornblende, forms strata by itself, to the exclusion of the other components (No. 93).

The stratification of the rock being quite evident, and the hornblende in such small proportion, we might be induced to call it sienitic gneiss; but, considering that the outskirts of the Neilgherries, as well as the plain for miles round, have hornblende slate for surface rock, I class under this last formation the rock at Avanashy.

All the buildings attached to the Pagoda are constructed of this rock, which contains imbedded nests of hornblende.

Mottipollium.—Near Mottipollium, and as we approach the Neilgherries, the hornblende is seen, not, as hitherto, forming elevations and hills, but only clustered masses jutting above the soil.

As in other localities, it contains veins of quartz and felspar, numerous pieces of which, when the imbedding rock decays, are scattered on the soil—close to the ferry of the Bowhany river, at Mottipollium, I found some boulders of granite, the felspar of which is reddish, containing abundance of mica (No. 94).

A few yards south and near the ferry, there is a knoll of a kind of stalactitic iron ore (No. 95); and in the plain I picked up a loose piece

of kankar, which offers an appearance and composition rather interesting. It is the modern, tufaceous, botryoidal kankar, coating a piece of black mountain limestone, of which last rock there is not a trace to be found within hundreds of miles of the place *in situ.*

Close to the foot of the Neilgherries, and up the lowest part of the Koonoor Pass, the strata of the hornblende slate are very much inclined, dipping eastwardly.

Conclusion.—From what has been stated we may draw the following conclusions.

1. That the geological appearances, in several places along the coast of Coromandel, render it probable that the whole coast was heaved up at some remote period.

2. That extensive estuaries must have indented the coast, previous to that period, to account for the fossil remains, both pelagic and terrestrial, many miles removed from the present shore.

3. That granite is the lowest rock in the localities mentioned in these pages, which is seen likewise forming isolated hills, and as erratic blocks on the plains.

4. That gneiss is the most abundant subjacent rock, to which the other inferior non-fossiliferous stratified rocks are subordinate.

5. That the trap rocks, such as basalt, porphyry, eurite and sienite, either as dykes, or as overlaying rocks, are injected through, and in, all the above-mentioned rocks; and that the basalt of this part of India cannot be classed with the floetz trap, as is the case with that further north in the Vindhya range.

6. That the laterite and the kankar of these places, the former being a conglomerate (like the molasse, the nagelfluh, &c.) and the latter a concretionary rock, must be considered as deposited from water; the kankar being of two sorts, the one ancient, and the other modern, still forming. In these two last re-conformations no organic remains have hitherto been found; much less in the inferior stratified rocks.

Quo magis his debes ignoscere, candide lector,
Si spe sunt, ut sunt, inferiora tua.

Ovid: Trist: lib: 1 Eleg: XI,

II.—*Notes on Persia, Tartary and Afghanistan.—By* LIEUT.-COLONEL MONTEITH, K. L. S. *of the Madras Engineers.*

The following notes were written some time since, at the request of a friend in Madras, for whom they were solely designed, and were never intended by me to come before the public. In some measure they may be found to differ from the reports of later, and more able, travellers; but they contain information I collected on the spot, and, in many instances, from sources to which the writers I allude to could not have had access. They are neither intended as a comment on, or contradiction of, any other statements, and are selected from a great number of papers, now rapidly decaying from white ants, insects, &c. as I never had any intention of publishing them. My long residence in Persia made me personally acquainted with many of the chiefs of tribes, to whom I am indebted for the statement of their numbers, and for some of the most agreeable moments I passed during my stay of 18 years. I was also in frequent communication with Tartars, and some of the Russian Mission to Bokhara; the published account of that Mission, however, furnished every information that could possibly be desired, and with less reserve than is usual in that empire.

The Caspian provinces, subject to Persia, consist of Talish, Ghilon, Mozanderan and Astrabad. The nature of the country, character of the people, their language and general appearance, and even the cattle of the country, form a strong contrast to the other parts of the empire, much more resembling those of India.

The mountains which divide them partake of this difference. The sides looking towards the Caspian are wooded nearly to the summit, and the others are bare, rugged and parched, the leading features of Persian scenery. The elevation of the range being about 7,000 feet, every degree of temperature is experienced. The low country near the Caspian bears, as is before mentioned, a strong resemblance to India; the charge of unhealthiness only applies to the swamps in the vicinity of the sea. After a slight ascent the climate is particularly fine, and from its dampness much resembles England, producing perpetual verdure. The strength of the country, through which a stranger cannot find his way, has generally saved it from foreign invasion. Its inhabitants felt few of the calamities which afflicted Persia, from the Afghan invasion to the establishment of the Kadgar dynasty, by whom Mozanderan and Astrabad have been particularly favoured, being considered their immediate patrimony, and the cradle of the Shea sect.

The people, in consequence, are generally richer and better lodged. A traveller passing through the country, would form a very false idea of the population and real extent of cultivation; the people, enjoying

great security among themselves, and being seldom visited by travellers, are not obliged to assemble in large villages, but are dispersed in houses, three or four together, over the country, always at some distance from the roads, or, rather, difficult paths, which traverse the rice fields and swamps. These are purposely kept in a difficult state, as well for protection, as to secure the monopoly of the carriage, no cattle being able to convey loads but those of the country. If a stranger, however, has a quarrel with any of the inhabitants, or attempts to press a guide, he will be soon convinced, by the assembly of a crowd about him, how great the number of people really is.

On the death of the King, or in case of foreign invasion, a few guards in the passes secure these provinces from the miseries to which the rest of the country is exposed, and the news brought by fugitives is all they know of passing events ; without they send forces to the aid of the contending parties. The Kadgars owe their reign in Persia to the troops of Mozanderan and Astrabad. In the latter district the chief part of their tribe (Kadgars) has long been fixed, and forms its guard against the Turkoman Tartars. They formerly were established on the Goorgan river, but have been gradually dispossessed of the lands on its banks, and forced to retire near the forest districts, where the Tartars seldom venture in force.

Russia gained possession of all the Persian provinces on the Caspian by treaty with Shah Sultan Hussain, in the time of Peter the Great, on condition of assisting that Prince against the Afghans and Turks. She never fulfilled her part of the engagement, and these districts were restored to Nadir Shah on his return from India. During this partial occupation a great number of men died from fevers, and Russia found none of the advantages she expected, either from the silk of Gilan, or sugar of Mozanderan. Their possession is still a favourite object with her, under the idea that they will render her independent of other countries for those valuable products, but in this I think she would be much disappointed.

The three Tartar tribes of Gouklan, Yamout and Tekie, are decidedly Persian subjects; like all frontier tribes they pay less respect to the orders of Government than those settled in the interior of the country, and, for some time, but little of any kind, owing to the weak and pacific character of the late king. I have, however, seen about 3,000 of their best horse, serving with the Persian army, of whom 1,000 were Tekies, and attached to the Erivan force, where I commanded the Artillery. During the winter the greater part of these tribes are encamped in the Persian territory, and on the Ottrak and Goorgan, the Persians can then do what they please, and they seldom venture to disobey orders, as they could not fly into the desert without abandoning their families, winter provision, cattle and property; and what they did carry off

would be plundered by the other Tartars, whether of Khiva or Bokhara, if they had not previously entered into engagements with them. The subjoined list gives the names of the different tribes, who form the principal and most formidable part of the Persian Cavalry, their principal force. The Infantry are either from the fixed villages or the great tribes of Lack, Loor and Boktearee (supposed to be the remains of the ancient Persians). This system renders the assembly of an army a matter of no difficulty, but keeping such a force in order, or even together for any length of time, requires a Prince of great firmness and talent, as in times of confusion the influence of these tribes is greatest, and a civil war is easily brought on and difficult to be subdued. Persia has always been a country not difficult to conquer in times of civil dissension, but, from the same cause, impracticable to retain. When the country is well roused, no army can long resist the incessant attacks of a force, always present, and never to be encountered. The nature of the country singularly favours this system of war; half of it is only fit for the abode of pastoral tribes, who care little for a change of residence, if it does not take place in winter, or at the time their flocks are bringing forth, when a march is destructive to their property. From the long and inveterate feuds which have existed between many of these communities, it is not difficult to form a party; but they soon get tired of any foreign power, and return to their own people. With one of a different religion, no dependence can be placed on their alliance.

The kings of Persia have always had the greatest difficulty in keeping them in subjection. Shah Ismail and Shah Abbas attempted to form a royal tribe, called the Shah Pussunds, or Shasewunds, by taking volunteers from all and giving them the best lands. The measure was not successful, and they quickly became the most unruly body in the kingdom. Nadir Shah being an Afshar, that tribe rose to great power under his family; to them succeeded the Zunds, of which Kerim Khan was the chief, and now the Kadgars. The present family have much reduced the power of the tribes, by raising regular troops and a corps of Artillery. This, with the party they are able to form, has been sufficient to restrain all but those of the province of Khorasan; had Abbas Mirza lived that too would have been perfectly subdued. In Azerbijan, formerly the most turbulent province, no tribe dares disobey the orders of government; but oppression has followed, and, in the late wars with Russia, they took no part in the struggle, and joined General Paskewitch's forces after the fall of Tabreez.

Travellers are much deceived, in forming their opinions of the resources of Persia, by judging of its population and fertility from what they see in merely passing through it. A considerable part of the country is desert, and all the great roads pass direct to their respective

points, and never through the fertile districts, which are all in the vallies of the high mountains, or at their feet. The cultivation generally depends on irrigation, and, in the plains, water is seldom to be met with, and the rain is insufficient for vegetation. You may march for days and not see a single village; at the same time be able to procure every supply from the keeper of the Caravanserai; 40 lbs. of bread for a Rupee is considered high, and 10 lbs. of excellent mutton may be had for the same price. The villages which supply these things are probably 10 miles to the right or left. An army, under the Persian government, would be directed to assemble at a certain point in some fertile district, and but a small part would follow the high road. The Khorasan troops annually come to the camp at Sultania, and 30,000 pilgrims pass the same way; they all purchase provisions without difficulty. An invading army could be deprived of this advantage, and it would be necessary to march by several parallel columns, joining at certain towns, where a large stock of provisions is always kept. An army should therefore have one month's supply of provisions; (biscuit is better than grain or flour). When the crops are on the ground, forage for the cavalry will be procurable, and the *country* ruined, and a famine generally follows the passage of a large army, if arrangements have not been made for at least one year before, and the meadows strictly preserved in the line the troops take.

The country between Russia and Persia, to the east of the Caspian and sea of Aral, is generally considered a desert, though formerly it comprised the powerful kingdom of Khorasm, and several parts of it, as Bokhara, Sameraud, Ko-Khan, &c. are described as the most agreeable residencies in the vast empire of Timur, abounding in great and flourishing towns, and frequented by merchants from every part of the world. It is at present much more thickly inhabited than is generally supposed, but, the population being principally migratory, it presents a very different appearance, according to the season of the year. In winter the low lands are covered with tents, where in summer not a soul will be seen, all having gone to the mountains or upper part of the rivers near Ala Taug.

Russia first settled the present government of Orenburg, and established the line of the Yaik, or Oral, in 1730. It was at that time infested by the Cossack pirates who had fled from the Volga, and joining the Baschiers and other Tartars, made irruptions into the neighbouring provinces. The town of Orenburg was then founded, and a line of forts drawn from the Caspian to the great chain of the Aral mountains. The Cossacks and Baschiers were taken into theservice of Russia, and formed into 12 regiments of 500 men each, to whom were granted lands, a small pay and freedom from taxes.

They have since been good subjects, and opposed the great Kalmook emigration, which, however, they were not able to prevent; the 60,000 families of whom forced the line and retired into China. The line was subsequently reinforced with 12,000* regular troops and artillery; settlers arrived from Russia, and it is at present one of the most fertile provinces supplying Ashterkhan, and other places, with a vast quantity of grain and provisions. The finest horses, and most numerous studs, are also kept here. This extension brought Russia in contact with the Kirgis Tartars, generally called Cossacks, the most powerful of all the tribes of Khorasm. After several years war, peace was concluded in the latter part of the reign of Catherine the 2d, and the tribes were allowed to pasture their cattle in the mountains forming the Russian boundary, on acknowledging the sovereignty of that power, which is content with a nominal rule, and the right of confirming the election of the Khan. They voluntarily furnished 5,000 horse during the French invasion, and, in the days of their power (they have not now half that number), counted 200,000 tents. To the west and north of the lake of Aral are the Kara Kalpaks, or black cap, Tartars, by whom the greater part of the Russian subjects are carried off and sold as slaves in Khiva; they profess themselves under the rule of Russia. To the south of these are the Aral Tartars, extending to Khiva; and the Persian Turkomans, who are not numerous and always live in fear of their more powerful neighbours. The whole of these are wandering tribes, but they cultivate a small part of their lands, which in many places are far from being barren deserts.

To the east of the Aral lake are several small states of the Usbecks, who pride themselves on being the descendants of Gengis and Timur; some of these are within the Chinese territory, which, notwithstanding its reported weakness, is gradually extending in this direction. The most powerful is Kashgar, from whence there is a direct communication with Cashmeer and Bengal, across the great Hindu Cush and Tibet. I have seen a Russian Armenian subject who had made several journeys to both places.

Kokhan, or more properly Koo-Khan (the Lord of the mountains), has several considerable towns, and a great number of villages, with fixed inhabitants, along the Sir Derria river and its branches. The chief of this country exercises a great influence over all the mountain tribes of the Ala Taug. The Chinese are pressing on his independence, and he will probably soon be subject to that empire.

Badakshan is frequently, but improperly, included among the Tartar states, and has sometimes made nominal submission to Bokhara and Cabul. The nature of their country, which is extremely mountainous

* Now more considerable, said to be near 30,000 men.

and difficult, protects them from foreign invasion. Through it lies a good summer road to Cashmeer, which caravans from Bokhara generally take. The people generally speak Turkish, but they more resemble Afghans than Tartars, and are extremely bigoted, and unfriendly to strangers; they may amount to 30,000 families and are celebrated as very brave infantry, of which their force is almost entirely composed. Merchants give them a good character for honesty.

Bokhara has been so minutely described, that there can be no use in my saying any thing on the subject. Few countries can boast a finer soil or climate; it is rich and flourishing, and, for several years, has had a succession of able chiefs, who can bring about 50,000 men into the field, and exercise a great influence in Tartary generally. The only remaining state, which has any thing to do with the present subject, is Khiva, which, before long, will become of the first interest; for it cannot be supposed Russia will allow herself to be insulted by a power she can at any time destroy, and the possession of whose territory will give her so much influence in the surrounding states.

The Khivians have always been notorious for their predatory habits, and have made most destructive inroads into Persia, within these few years; they are also at constant war with the Kirgis and Aral Tartars, and even with Bokhara, and, in fact, with every place which offers any hope of plunder. Like the Algerines, they are the pirates of the desert, and it is only singular, from their real weakness, that they have so long been allowed to exist, and injure with impunity much stronger states. The difficulty of attacking them is certainly great, being, every where, except on the side of Bokhara, surrounded by deserts; but greater obstacles have been overcome, and it will, probably, not be many years before a Russian garrison is firmly established in this nest of thieves. Nadir Shah took it on his return from India, and exercised his usual severities on those that offended him. The Usbecks, who are the leading power in this quarter, expelled the garrison he left, and he never had time to regain it.

When Catherine the 2d, sent to demand her subjects, kept in slavery at Khiva, the chief desired her to come and take them. Fortunately for Khiva she died soon after, when organizing a force to attack them both from the Caspian and lake of Aral. The possession of this point will secure Russia the command of the navigation both of the Lake and the Oxus, to within 250 miles of Cabul, and less than 60 of Balk. To effect this, she has no occasion to seek for the assistance of any other state; she can at any time call out a sufficient force of her Tartar subjects, to assist a small army in passing the deserts, and the heavy artillery (if such is required) may be conveyed by the lake of Aral and the Oxus. I think the western side of the Aral will be preferred. Some years ago the Yaik Cossacks joined the Tartars, in a predatory

expedition against Khiva, whose territory they plundered, and 800 Cossacks established themselves on an island at the mouth of the river. They only returned at the command of the Russian government.

I do not purpose entering into the much agitated, and little understood, question of Russian invasion of India. That a great and increasing state, will continue to gain on the savage tribes on its frontier, is but the usual course of things, and which nothing can long prevent. On once passing her present limits, she must fix her new frontier line either on the Sir Derria, or on the Oxus, as on the banks of these rivers only can she find lands, or even water, for the support of the frontier posts. The Oxus presents so many advantages over the other, that I cannot suppose there will be much hesitation on the subject. This river is navigable for boats from the mountains of Baduckshau to the sea of Aral; the power commanding its banks must exercise a great influence over both Persia and Afghanistan. For trade alone this would be a great object, and probably the one now really aimed at; and, in the first instance, Khiva will be occupied, and probably colonized with Cossacks or Tartars from Russia. Some advantage in point of territory will be, at the same time, offered to Persia and Bokhara. Under no circumstances can Khiva expect aid from the surrounding states; she has too deeply injured every one, to expect any thing but enmity from her neighbours, and her own power is totally unequal to any effectual resistance. With Bokhara a good understanding will, if possible, be established. From this position, in the event of a quarrel with England, by demanding a passage for troops, assembling soldiers, and making a shew of invasion, Russia would threaten our possessions, and oblige us to make preparations against her, besides keeping embassies in the neighbouring states. I am firmly persuaded that for some years she could not make any serious attempt or permanent impression, except through our own negligence. The aid of Russia would without doubt be eagerly courted by the different families now disputing the possession of Afghanistan, and repelling the Seiks; or Persia would be happy to avail herself of their aid to recover Herat, and her former possessions in Khorasan. But it is useless speculating on the probable conduct of a state, which has every chance of falling into anarchy, and being incapable of any efficient external exertion. Civil war may bring forward some bold and able chief, like Nadir Shah, who will soon change the political state of his country.

For any enterprise of Russia, either actually to invade, or threaten, our possessions, the route by Tartary is, in my opinion, preferable. The line of her operations can be secured, from Orenburg to the banks of the Oxus, by her own Tartar subjects; she can convey the necessary stores and supplies the greatest part of the way by water, with the

same facility we ascend the Ganges, or greater, as the current in the former river is less rapid than in the latter. Her army will be perfectly free from all fears regarding the conduct of Persia, where the most trifling circumstance might bring on a rupture with the tribes who care but little for the royal authority, and which no precaution can always prevent. The length of the march would most materially be diminished, and the extent of desert to pass not much increased. One flank of the army will be covered by the double barrier of a great river and considerable desert; and the force, which under all circumstances she must leave at Khiva, would sufficiently protect her against any attempts of Persia, even if she were inclined to oppose the enterprise; in fact she would have nothing whatever to do with that kingdom.

On ascending the Amoo, or Oxus, to the point nearest Balk, a considerable corps must be established in an entrenched position, and the real land journey commenced, entirely through the countries subject to the Afghans. Their own vast empire, and the parts of Tartary through which they will have passed, abound in camels, horses and other cattle, so no difficulty need be anticipated regarding carriage. Balk is a considerable province where provisions would be obtained, and the country between it and Cabul, with the exception of the Hindu Cush, is partially cultivated, and generally travelled by caravans and numerous bodies of people.

From Balk all the influence Russia may possess in Tartary ceases, and she must either obtain a passage through the territory of the Afghans by treaty, or be prepared to fight her way; to the last mode of proceeding, there appear difficulties so great, that they might be considered insurmountable, had we not seen Nadir Shah overcome them with apparent ease, and in a short space of time, even when the Afghan monarchy was in its power. The actual state of that country appears to favour such an enterprise. Herat, and the principal part of the great tribe of Dooraney, still adhere to Kamraun Mirza, or any other member of the Soddozye branch, whilst Candahar, and the principal of the other provinces, are held by Doost Mohamed Khan, chief of the Baurikzyes division of the same tribe (Dooraney). He again, is pressed on his eastern frontier by the Seiks. It appears to me, negotiation could hardly fail to gain the assistance of one or other of these chiefs. By the aid of her army the Afghans would probably soon recover all they have lost by their internal dissensions, and it would be equally certain of crushing the opposite faction. So supported, their march to the Indus appears to me, though difficult, not doubtful.

In forming an opinion of the probable result of the approach of an army, by the route I have mentioned, it is necessary to take into particular consideration, not only the political relations which exist between

the Afghans and their neighbours, but also the peculiar formation of their government, which materially differs from that of the surrounding countries. The great tribes of Afghanistan more resemble an alliance of separate independent states, and those of a most democratic form, than the despotic kingdom of an Asiatic sovereign. This kingdom has not been sufficiently long established, to allow the sovereign to divide, and break into different clans, these formidable bodies, who have, in the space of one hundred and thirty years, three times changed the dynasty.

The Ghilegies, in the early part of the last century, under Mir Veis, revolted from Persia, conquered it, and held possession, till expelled by Nadir Shah, who again fully revenged the injuries inflicted on his country. After his death Mahmood Shah and Zeman Shah both reigned in Afghanistan, from the Soddozye branch of the Dooraney, and Doost Mohamed Khan, chief of the Baurikzyes, now promises to join the same station. The power is too equally balanced, for any chief ever to exercise more than a nominal authority over any but his own tribe. The towns, and some lesser tribes, who have not power to resist the particular one of which the king may be the head, are all he can really command. So full and admirable an account of these divisions has been given by Mr. Elphinstone in his journey, that any thing I could say would only be a repetition of his observations, with far less pretensions to correctness. My information was chiefly derived from some of the exiled chiefs, who were at the Persian court, and resided there nearly from the time Mr. Elphinstone had been in their country, and I only give the following list to shew the strength of the leading tribes. Besides there are many smaller ones, who altogether amount to a considerable number, and generally follow the fortunes of the ruling party, being equally oppressed by all, with little attachment or fidelity to any. Such a state can muster a most formidable power for foreign invasion, and the conquest of the neighbouring countries is much easier than the establishment of a firm government at home.

Great Tribes of Afghanistan.

Of Tartar origin.	Eimuks..... Families	80,000	about 400,000 souls.	
	Hazarahs..........	70,000	350,000	
	Usbecks tribes of Balk.	200,000	1,000,000	
	Eusofzyes..........	150,000	750,000	Shah Kamran Mohamed Shah, Sha Shudjah.
	Dooranies..........	130,000	650,000	
	Deduct Baurikzyes..	50,000	250,000	Dost Mohamed Khan's.
	Ghilgies...........	100,000	500,000	Tribe of Meer Vois and the conquerors of Persia.
	Turcolanies	20,000	100,000	
	Upper Momunds.....	10,000	50,000	
	Kyberies...........	25,000	125,000	
	Peshour tribes about	350,000	1,750,000	But divided into a great number of small tribes, therefore subject to the government.

There are a great number of smaller tribes, particularly on the mountains, whom it would be needless to mention. I was entirely guided in my enquiries by the Honorable Mr. Elphinstone's account of the country, and found a perfect confirmation of his statements. The fixed inhabitants even become subject, within the limits of the tribes, to their chiefs, so but a small portion of the actual revenue reaches the royal treasury.

The Afghans have been only known, as an independent state, since the beginning of the last century, and their empire then was formed by several provinces severed from India and Persia. They were again subdued by Nadir Shah, who, had he lived, would certainly have broken the union of the tribes. He had marched some large bodies into Persia, and intended planting them on the Turkish frontiers, filling up their places with Persians. Assad Khan he had actually taken to Erivan, and orders had been issued for 100,000 families to be removed to Kurdistan, and the Kurds, and other ill-affected subjects of the Turkish frontier, to go to Afghanistan. On his death Assad Khan quitted Erivan, and forced his way, with great talent and courage, to his own country ; he had about 5,000 men.

The tribes of Persia have been for ages under a despotic government, and at times one of great power. The chiefs have been obliged to frequent the court, enter into its intrigues, and expend in the capital the funds which enabled them to preserve their ascendancy, and make the men under them efficient.

The King also fomented the dissensions among the sons and relations of any very powerful chief, whose tribe has thus been divided into several branches, and the first opportunity taken of removing them to distant parts of the country.

The fixed revenues of Persia are also much more considerable, as also the population of the towns, which gives them a greater command of the materials of war. The establishment of regular troops has given the finishing blow to the importance of the wandering tribes, as a military body ; great numbers of the people are now established as cultivators, still retaining the name of their tribe. In times of civil war, as these large bodies enjoy more security from petty oppression than the villagers, a considerable number of the latter join the tribes, who are then much augmented in number ; they return to their villages when tranquillity is restored. In summer, when the tribes remove their tents to the mountains (if they have not fixed estates in villages), they will seldom listen to any orders of government, having it in their option to remove to another province or even state ; but when the roads are blocked up with snow, and no pasturage on the waste lands, they hold a much more submissive tone. On this account the Persians sel-

dom make any demands till that season. If fears are entertained of their fidelity, hostages are taken from the heads of families, and sent to the capital, or other remote towns.

Regarding the invasion of India through Persia, I will only say a very few words—the subject having already occupied the attention of government and the diplomatic agents, for these last thirty years, and the fullest details, in consequence, having been furnished.

From all the experience I have had, in eighteen years residence in Persia, I am perfectly persuaded that, if the government of that country were sincerely to aid a Russian army, there is no obstacle to its advancing as far as Herat or the Afghan dominions. In fact this space has been passed many times during that period, by larger bodies of men than the army ought to be composed of; under the circumstances above mentioned, it is supposed that Persia will be in alliance with, and aiding, Russia. All the troops it would be advisable to have as her contingent, ought to, and might, be collected in the province of Khorasan. To reach this, the best and shortest route, for the heavy part of the force, is from Astrabad up the Goorgan, and, through the country of the Khorasan Kurds, to Meshed. The next point to be gained is Herat, which will not be a very difficult task. As far as this place the population is favourable, being old subjects of Persia. From this they must fight their way to the Indus, for it cannot be supposed that any thing they can offer will induce the Afghans to part with their western provinces, the possession of which alone can be a supposed inducement for Persia to enter heartily into such a war. The enterprise is practicable, but difficult; armies have passed three times by this route in the last hundred years. Persia is not, at the present moment, in a condition for any power to put confidence in her political relations. Though the present king has certainly gained the throne with less difficulty, and in a shorter period, than could have been expected, he cannot be said to be firmly established, and in the event of any reverse, the people generally, who are far from being attached to the Kadgar dynasty, would probably revolt. He has besides killed Mirza Abul Kassim, his able prime minister, to whom he chiefly owed his success, who, with all his faults, and they were both numerous and great, was, without doubt, the ablest man in his court or in that of his father. The Azerdbijan troops, by their conduct in the civil war, and in Khorasan, have shewn of what excellent materials the Persian soldier is really made, and that the trouble taken by the English in their organization, has not been thrown away. If they failed in the war with Russia, it was from no fault of theirs, but what results from all irregular government, when no fixed system of war or policy can be depended on.

List of the Nomade tribes subject to Persia, with the supposed number of families and place of residence.

Names.	No. of families.	Place of residence.	Remarks.
Tribes of Turkish origin.			
Afshars			Scattered in several provinces, and subdivided into the following clans: Karatchlu, Imaumlu, Dawoudlu, Hyderloo, Jargaulu, Osallu, Kilidglu, Gani, Begloo, Hassansalu, Killeloo, Yeherloo, Toutmaklu, Adeklu, Kouhguelu, Kara, Hassanlu, Ali Beglu, Terzilu, Shah Baranloo.
	6000	Rhumia.	
	3000	Khumsa.	
	1000	Kasween	
	1200	Hamadan.	
	1200	Tehran.	
	2000	Shuster.	
	1600	Kerman.	
	2500	Khorasan.	
	500	Fars.	
	1000	Mozanderan	Altogether 20,000 families. Nadir Shah was from this tribe.
Makuddum	2500	Azerdbijan	The principal part of this tribe is situated at Maraga, and the chief, Ahmed Khan, got possession of that district, and had great influence in Azerdbijan.
Dumbulu	4000	Azerdbijan	Residence Khoey, of which Jafeer Couli Khan was chief, who rebelled against the king and fled to Russia. The tribe now of less importance.
Turkman	1200	Azerdbijan.	These must not be confounded with Turkoman Tartars. I doubt there being any thing more than families, exercising the trade of shepherds; they take charge of the cattle and sheep of villages in summer, and return them in winter.
	1000	Hamidan.	
	500	Fars.	
	1000	Mozanderan.	
	5000	Persia generally.	

Names.	No. of families.	Place of residence.	Remarks.
Tribes of Turkish origin.			
Kangerloo	1200	Azerdbijan	This small, but brave, tribe held Nuckshewan from the time of Timur, by whom they were planted here; Kelbel Ali Khan was their chief. They now are Russian subjects, and gave up Abbas-Abad to the Russians.
Sha Dulla	1600	Erivan	Now subject to Russia.
Kara Goosloo	12,000	Geroos	This tribe are great robbers, and settled on the Bagdad frontier.
Einaloo	1000	Einaloo.	
Biaut	10,000	Erivan	Scattered in Azerdbijan, where the district of Makoo entirely belongs to them; they are to be found in Tehran, Nishapoor, Fars; originally from Erivan, where at present about half the tribe are settled.
Begdilloo	1000		Divided between Azerdbijan and Sawa in Irak.
Kurdpitcha	1500		Azerdbijan and Irak.
Turk Mafi	500	Fars.	
Khehimlu	600	Yesdikhast.	
Fars Modanloo	2000	Fars.	
Neser Bechelu	2500	Fars.	
Moganloo	1200	Mogan	On the banks of the Arras, generally robbers, and a disreputable tribe.
Kodjawend	1000		Mozanderan and Gillan.
Abdul Melike	600	Mozanderan.	
Khuda Bendilloo	1500	Kermansha	Shah Khuda Bendi from this tribe. He built the great mosque at Sultania.
Hadjiler	2000		Mozanderan and Tabreez.
Shah Sewund	20,000		This tribe was composed of volunteers from all the tribes by Shah Abbas the Great; it

Names.	No. of families.	Place of residence.	Remarks.
Tribes of Turkish origin.			
			is now distinct and much scattered. Atta Khan, the chief of the Azerdbijan branch, has 6,000 men. They are a very warlike tribe, and possess Mishkeen, and several frontier districts, not well affected to government.
Eyramloo....	1400..	....	Astrabad and Mozanderan.
Ustedjerloo...	800..	Azerdbijan.	
Saudjelu....	1000..	Azerdbijan.	
Jewan Shier..	2000..	Kara Baug....	Punna Khan, the chief of this tribe, conquered Kara-Baug, on the death of Nadir; his son Ibrahim Khan, was killed by the Russians; they now belong to that empire.
Koinlu.......	1500..	Erivan..... ...	About 500 only of this tribe now are Persian subjects, and settled near Khoey.
Dejeler......	3000..	Kelat and Khorasan.	They possess the strong district, and impregnable fort, of Kelat; a great part of the treasure of Nadir Shah was deposited here.
Khaledje.....	8000..	Sawa..........	I doubt of these being Turks; if they are, they must be Moguls, as they speak a distinct language. A few hundred families are in Azerdbijan.
Boulverdi...	1000..	Fars.	
Seidler......	1000..	Azerdbijan....	Formed principally of Sieds and settled in Khul Khal.
Kashkai....	2000..	Fars.	
Adjerloo....	1500..	Ispahan.	
Kadjars.....	5000..	Astrabad......	The present royal family of Persia is derived from this division of the tribe. They were incorporated into the Afshars by Nadir. They originally came from
	1000..	Merr.	
	500..	Erivan.	
	1000..	Ganga.	
	300..	Casbine.	

Names.	No. of families.	Place of residence.	Remarks.
Tribes of Turkish origin.			Syria, and were placed by Shah Ismail on the most exposed frontiers, Erivan, Ganga and Derbund, to the west, and Astrabad to the east. The western division could not keep their ground, and all but a few joined the eastern branch, still retaining the names of the places they formerly inhabited. They have another division of the upper aud lower tribe ; the clans are Kavullu, Devellu, Kiaklu, Dabenlu, Soutchanloo, Kirlu, Ezindinloo. They accompanied Gengis Khan's army into Asia minor.
Kurdish Tribes.			
Rechewend...	2000..	Zenjan........	District of Tarim on the Kizil Ouzan.
Eubarlu.....	800..	Ditto........	Ditto.
Jehan Beglu.	1,000..	Mozanderan	
Shekaki.....	12,000..	Azerdbijan ..	This formidable tribe disputed the sovereignty of Persia with the present King, and held the greatest part of Azerdbijan, during the Zend dynasty ; they possess the districts of Sir Al, Khul Khal, Hushtarood and Germarood. They are ill-affected to Persia and joined the Russians in the last war.
Kotchanlu...	2,000..	Kermansha	
Zaferanloo..	20,000..	Khorasm	These extend, on the Tartar frontier of Khorasm, 50 miles from the Caspian to near Meshed ; they were removed by Sha Ismail from Turkey, and are now as dangerous as the Tartars, whom they have ruined

Names.	No. of families.	Place of residence.	Remarks.
Kurdish Tribes.			
			along their part of the frontier. They are governed by their own prince or Walli.
Boinos	2000.		
Tazagine	1000.	Tehran and Mozanderan.	
Sepeki	8000.		Along the frontier, from Sein Kulla to Erivan.
Mekri	5000.	Soudg Bullak.	The division inhabiting Persia consists of about 5000 families, but the chief of Soudg Bullak, by his connection in Kurdistan, can command nearly as many horse. His districts ought to pay no tribute, being held by military tenure; and he furnishes 3000 fine cavalry, entirely at his own expense.
Senna			The prince, or Walli, of Senna furnishes 5000 men to the army, and the best looking troops in it. He is a hereditary chief, and held the second place at court. immediately after the Walli of Persian Arabia. He can command in his own country 30,000 men.
Aral Tribes.			
Boustami	4000.	Boustami	These are now generally settled in villages. They came from Arabia with the first conquerors, and are principally infantry.
Thouni	6000.	Khorasm.	Settled in villages; brave infantry.
Djeudaki	2000.		Desert between Khorasm and Irak.
Adertani	1500		These tribes are fixed, and take their names from the provinces
Kermani	1500		
Seistani	2000		

Names.	No. of families.	Place of residence.	Remarks.
Arab Tribes.			in which they are settled; they now speak Persian, or the language of the districts in which they are established.
Agdkani....	5000..	Fars.	
Chab........	....	....	This district is sometimes subject to Persia; the Sheik's territories extend from the Caroon to Hinduan, along the Persian gulf. He once mustered 20,000 men—half his territories are in Turkey.
Loor or ancient Persian Tribes.			
Zend........	....	....	From this tribe was Kerim Khan, and the Zend dynasty.
Mafi.			
Naneguelu.			It is impossible to give any correct statement of these tribes; they inhabit the difficult mountains on the western frontier, and are always in an unsettled state, and are the most lawless tribes of the whole country. Looristan formerly was governed by its own chief, under the name of Walli, and was supposed to have 50,000 families under him; this I think rather under than above the truth.
Badjunlu.			
Beiranewund.			
Pairwend.			
Sekwund.			
Karkani.			
Zukrewund.	50,000		
Rebhour.			
Sadewund.			
Djelewund.			
Kaisewund.			
Abdilewund.			
Tchigine.			
Wermeziar.			
Zenguina....	2000..	Kermanshaw.	
Feile........	10,000..	Looristan.	
Kara Zeudjiri	1500..	Kermanshaw.	

Names.	No. of families.	Place of residence.	Remarks.
Loor or ancient Persian Tribes.			
Bukhlearee...	40,000..	Bukhlearee..	This province, included in Irak, extends from Ispahan to the frontier of Arabia and Bagdad. The whole country is a difficult mass of mountains, where the king of Persia's authority is little known. This tribe ought to furnish 12,000 men, formerly the most celebrated infantry in the army. They, with the other Persian tribes, speak a distinct language, with a great number of Persian words in it. The people have no towns and few permanent villages. Three battalions of this tribe were placed under an English officer, who was much pleased with them; he had no difficulty in keeping them in order.
Lacks.......	20,000..	....Fars......	Resemble the Bukhlearees; some good horse from this tribe.
Mohamed Senni.....	10,000..	....Fars......	Country between Babahan and Sheraz very strong, and peopled by notorious thieves. Same language as the Loors and Bukhlearees. These tribes inhabit the belt of mountains extending along the western side of Persia, from Kermanshaw to Kerman, a distance of 400 miles in length, by 60 in breadth, containing several fine valleys and a few towns. I crossed the mountains in three different directions.

It is necessary, perhaps, to state, that this paper was written some time ago, and that I am not in communication with any person now in Persia, consequently cannot give the particulars of the comparatively easy accession of the present king, under most unpromising circumstances. For this he appears to have been principally indebted to the aid of his late Vizier, and the few English officers in Azerdbijan. Once master of Tehran and the treasure, all was simple, and he had ample means for paying and keeping up an army. The Prince of Shiraz had no pretensions to talent, or courage, and was, from his infamous conduct, an object of detestation to his subjects, whom he had abandoned to the worst of his favourites. How he has mastered the other provinces has not yet transpired; but I am far from thinking the troubles yet at an end. It is, however, necessary for him to put the allegiance of the chiefs to the test, and the intended movement on Herat is probably intended for that purpose, it being a most popular enterprize in Persia generally.

Having been only acquainted with him as a boy, I cannot say what his character may now be. At sixteen years of age, he was indolent, but far from deficient in talent; mild, and kind to those about him, but not considered as possessing energy. Three years military service under his father may have much altered his habits.

Regarding the troops permanently under British officers, and exclusively raised in Azerdbijan, I can speak of them only in terms of the most unqualified praise. Hardy, brave, submissive and easily attached to their officers, I heard no complaint by those who commanded, and have none to prefer myself; their successes, which were much more frequent than is generally known, they owed to their own energy and courage; their defeats to the want of the necessary qualities in those commanding. When the necessity for bearing hardships was evident, none could do so with greater patience, and even cheerfulness. With bread and water they were perfectly satisfied, though accustomed to live well at home. The troops, who chiefly bore the brunt of the war with Russia, were—

2	Battalions of	Tabreez.	1 Battalion of Mehrande.
2	do.	Shekakey.	1 Regiment of Lancers.
2	do.	Kara Daug.	8 Troops of Horse Artillery.
1	do.	Khoey.	2 Companies of Foot do.
1	do.	Rhumia.	

The regiments of Erivan and Mechshewan are now Russian subjects; some have served with Russia against Turkey. The irregular troops were from the tribes, and may have been nearly 20,000 men. The whole province may have contained about 1,000,000 souls, and paid 800,000 tomans (12*s.* each) in taxes.

III.—*A cursory View of the present state of Astronomical Science, with a summary of Desiderata; together with a Notice of the Astronomical Results at the Madras Observatory.—By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

Many, perhaps the greater part of, Europeans in India, are aware, that, through the munificence of the Honorable East India Company, an Observatory of some importance is supported at Madras, and some few have probably learned that the result of the observations made at the Madras Observatory, are from time to time published, and consequently are available to the amateur Astronomer and the public at large.

That the Madras results have not been very generally noticed, is a fact which cannot but obtrude itself on my attention, from the circumstance of my having lately been applied to by several individuals, in various parts of India, enquiring—what is done at the Madras Observatory ?—in what way can an amateur Astronomer render himself serviceable ?—and what, by Astronomers, at present are considered *desiderata* in the Science ?

With a view of answering these enquiries, I have thought it would be acceptable to state, as far as has come under my notice, and in as brief a way as possible, the recent views and occupations of the several Astronomers, who preside over the principal public and private Observatories of Europe ; and, for myself, to claim a little further, and more particular, attention, to results which have been derived from the Madras Observations.

The pursuits of the Astronomer of the present day, it must be observed, differ, in no slight degree, from those which very properly belonged to him at no more distant date than the commencement of the present century. At that period our knowledge of the motion of the Moon and Planets, compared with the refinements which now obtain, was but very rude and approximate; inasmuch as errors in the place of the Moon frequently amounted to 40 or 50 seconds of space, and errors in the places of the Planets as frequently amounted to 30 or 40 seconds. It is to the observations made during a long continued period at the Royal Observatory at Greenwich, aided by the theory of Euler, La Grange and La Place; and the computative skill of Mayer, Mason, Burg and Burckhardt, that the superior accuracy, we at present have attained, is due.

The nature and extent of this accuracy will be better understood from the fact that, ten years ago, the Board of Longitude intimated that no further improvement in the Lunar tables was expected or required—the largest errors, to which they were then liable, never permitting an error exceeding eight miles in the longitude ; and the places of the

Planets could be predicted to nearly as great an accuracy as they could be observed*.

Hence it would appear that, for the purposes of navigation, Astronomy holds out no further prospect of assistance. It has laid the foundation of tables and computations, which, unless there should occur some (now not apparent) disturbing course, will last for centuries.

What then is left to be done? Astronomy has effected, for the immediate wants of mankind, all that is necessary and useful—shall it be laid by upon the shelf?

The best answer to this question arises out of the fact, that, during the last twelve years, the public Observatories, in different parts of the world, have been nearly doubled in number, and the number of private Observatories—now (from the increased size and excellence of the instruments employed) well deserving the name—have been more than trebled.

What then have Astronomers found to occupy their attention?—is the next question which naturally will be asked. The answer is ready. At one of the principal Observatories of Europe, we perceive the Astronomer, aided by the best of instruments, devoting his time, during twenty years, to the determination of the places of a catalogue of no more than one hundred stars—The end has been accomplished!—The said places of these one hundred stars have been determined, with an accuracy not yet attained in any other Observatory, and they form the zero point, from which every wise Astronomer should take his departure.

At another principal Observatory, the Astronomer, not contented with the present accurate tables of the Sun and Planets, has been devoting his attention, almost exclusively, to the determination of their places, with a view to attaining more perfect accuracy. One important result arrived at, is, that the masses of the planets, Venus, Mars and Jupiter, have been heretofore assumed erroneous to some amount; added to which, the observations will, probably at no very distant date, form the basis of a set of tables, which will be short only of perfect accuracy.

At two other Observatories in southern latitudes they have been determining the places of southern stars, which are not visible to the observers in Europe. In the course of a few years several hundred stars have been observed, which now constitutes nearly all our knowledge of the southern stars.

At another private Observatory, we find the observer, during several years, devoting his whole time, and telescopes of very superior powers, to the observation of double and treble stars. These observations have put us in possession of the fact, that there are certain stars, which revolve around one another, or, rather, around their common centre of

* This does not include the four smaller Planets.

gravity, conforming to the Newtonian laws of gravity, equally with the bodies which compose our system. Among the several stars which have been examined, some have been found which perform their revolutions in the comparatively short periods of 40 or 50 years, whilst others, again, there are, that take up fifteen hundred years, to perform their circuit.

Of one of these (γ^1 Virginis) the Astronomer just mentioned* (who has lately removed to the Cape of Good Hope, where he is now devoting a most particular attention to this class of observations) was pleased to give me, in a letter dated Cape, 7th January 1836, the following information :

" I made an interesting observation here a few days ago on γ Virginis. That star is now *single;* the two individuals are yet so close, that no magnifying power I can apply to the seven feet equatorial, shews the disc otherwise than *round*—not even elongated—yet, as the star preserves its apparent " magnitude" to the naked eye, it is clear that no part of the body of one star is hidden behind the body of the other."

The same individual has lately been occupied in verifying the places of the satellites of *Uranus.* It is well known that the late Sir William Herschel (the discoverer of this planet) has assigned to it six satellites. But, from the circumstance of Sir William Herschel being the only individual who has ever seen these satellites, and from his having obtained but a very limited number of observations of them; added to the fact of his having assigned to them a motion perpendicular to the plane of the ecliptic (a motion different from that observed in the other twelve secondaries); it has been suspected that he might have mistaken some minute stars for the satellites.

The observations, lately made, have shewn, with regard to two of these satellites, that the motions assigned to them by Sir William Herschel were very nearly correct, differing, in the case of the first satellite, less than half a minute for the period of its revolutions; and, for the second satellite, agreeing to about one minute and three quarters.

Other observers we find who are variously engaged—In observing, for instance, the position of stars near the moon's path, for determining the longitude form occultations ; or in observing stars near the planet Mars, for the determination of his parallax ; or in *sweeping* the heavens, night after night, for the purposes of laying down the places of nebulæ, or discovering comets. The steady pursuit of this latter class of observation, has made us acquainted, during the last ten years, with the comets of Biela and Encké, as forming a part of our system ; the former traversing its orbit in three years and a half, and the latter in six years and eight months.

* Sir John Herschel.

Last, though not least, Astronomers, in various parts of Europe, have lately been simultaneously employed in laying down the approximate place upon a chart, of all the stars in the heavens, within certain limits of declination, down to the 12th magnitude; each Astronomer undertaking one hour of right ascension, or one twenty-fourth part of the work. The purpose for which these observations were undertaken, was to determine if any planets yet remained undiscovered in our system. Up to the present time none have been discovered, but we may hope, in a few years, when this examination shall have been repeated, that we shall be able to pronounce, with certainty, the number of planets which compose the solar system; for, it is almost needless to remark, many planets may possibly exist, of small dimensions, of which we now have no knowledge.

In addition to the above, there are several points to which attention, at a well appointed observatory, might advantageously be directed, which from their importance may properly be called the *desiderata* in astronomy.

At present Astronomers consider the following points among the *desiderata:*

1st. A large catalogue of the right ascension and declinations of the principal fixed stars. The catalogue should contain at least 3,000 stars, judiciously selected, and should attain to an accuracy of half a tenth of a second of time, for the right ascension, and be correct to one second of space, for the declination.

2d. A set of accurate observations, at various points upon the surface of the earth, of the altitude of the fixed stars, from fifteen degrees of altitude down to the horizon; the observations should comprehend all possible varieties of temperature and pressure, and the most scrupulous care be paid to the states of the barometer, thermometer and hygrometer.

3rd. Accurate observations of the planet Mars, and of stars near to his path at the time of the opposition, for the purpose of finding his parallax.

4th. Observations for a more accurate determination, than we at present possess, of the amount of the nutation of the earth's axis, caused by the action of the moon.

5th. Observations directed to the determination of the density of the planet *Saturn*. At present its density is assumed to be one eighth of the density of the earth; but this requires verification.

6th. Observations tending to point out the nature of the discrepancies, which at present affect the tables of the Sun, Moon and planets, generally.

7th. Observations tending to establish, or refute, the at present received opinion, "that the solar system is replete with an ether." The

density of this ether has been computed, from the observations hitherto made, to be eight hundred times lighter than atmospheric air.

8th. Observations to determine the annual parallax of the principal fixed stars.

9th. Observations of the proper motion of double stars around one another, and of the fixed stars generally. It has been supposed and it appears very probable, that the solar system is in motion in space; to determine which, accurate, as well as long continued, observations of the proper motions of the fixed stars are necessary.

There are, in addition to the above, several other *desiderata*, which, being of minor importance, and forming a very numerous class, it might be tedious here to notice.

With regard to the points, to which the observations made at the Madras Observatory have been directed, I may call them those of a *general* nature; hence it will be as well to mention them in the order in which they occur in the Madras Results.

In the first place, the determination of the mean diameter of the sun, is one to which some considerable attention has been paid, with a view to discover if any difference existed between the solar and equatorial diameters. Our observations of all the planets (including the *Earth*), shew that the difference of their equatorial and polar diameters varies, in proportion to the rapidity of the motion on their respective axes: a fact which immediately results from supposing the particles composing the planets to be capable of yielding. In the case of the sun, then, which revolves on its axis in 26 days, a very small amount of difference should result. M. La Place *computes* its amount to be less then one second of space.

The observations made here for this purpose are as follows:

	′	″
From 965 observations of the Equatorial semi-diameter......	16	1,48
—— 141 ....Polar semi-diameter............	16	1,59

The small difference which is here observed, in a contrary direction to what might be expected, is no doubt due to error of observation. This accounted for, we may assure ourselves that the sun is perfectly spherical, and that it is composed of solid and unyielding materials.

With regard to the Sun's distance from the *Earth*, the observations made of the planet *Mars*, and of stars situated near to his path at the times of opposition in 1832 and in 1834, when compared with similar observations made at the Cape of Good Hope Observatory, enable us to compute the angle, under which an observer situated at the planet *Mars*, would view these two observatories.

Now the *relative* distances of the plan et *Mars* and the *Earth* from the *Sun*, are known from the laws of gravity; hence, from the above measure of the angle under which the Madras and Cape Observatories appear at the planet *Mars*, we can compute what would be its measure at the Sun, and, the geographical situation of the observatories being

known (their distance in fact), we can determine the angle under which the whole diameter of the *Earth* appears, when viewed from the *Sun*, and hence the distance.

The results of 1832 and 1834 give the angle, under which the equatorial diameter of the earth appears, when viewed from the sun, and at her mean distance, = 9″, 253, which gives the mean distance = 88,319,500 miles.

The comparison of the observed places of the sun and moon and planets, with their places predicted in the Nautical Almanac, shews that, with the exception of the four small planets, *Juno, Ceres, Pallas* and *Vesta*, the places from observation are scarcely more accurate than the predicted places.

The next result arrived at, is one of some importance, namely, the position of the equinoctial point. It need hardly be remarked, that the equinoctial point being the zero, from which we measure the right ascension and longitude of the heavenly bodies, any error, in assuming its position, will affect, by the whole amount, the determination of every place (whether it be of a fixed star or planet) which we observe. The late Dr. Maskelyne, the Astronomer Royal at Greenwich, determined the true position of the equinoctial point with considerable care, in the years 1790-1800 ; and in the years 1811-1820 the late Astronomer Royal (Mr. Pond) stated that the point thus determined was in error, to the amount—0,31″ of time. Since this time, other observations have been made thus—

	Error of Eq. Point deduced by Maskelyne
From Greenwich observations in 1811—1820	— 0,31
—— ——— ——— — 1820—1827	— 0,21
—— Madras ——— — 1832—1835	— 0,11

Here we find a progressive change in the place of the equinox, different from that which, according to theory, ought to obtain ; for, the values above formed should (if Maskelyne's observations be correct) be all=0. The discordance at the first date is too large to arise from any probable error of observation, and the progressive change (which follows the order of the date) is, to all appearance, due to some cause, and not to accidental error of observation.

Should future observations prove this position to be true, the discovery will be an exceedingly interesting and curious one ; but, from the minute amount of the variation, many years must elapse, before any thing like a proof of its existence, will be obtained from observation, or its cause accounted for by theory.

The further results furnished from the Madras observations are the longitude and latitude of the Observatory, thus :

Longitude	of the Observatory	*h.* 5	*m.* 21	*s.* 8	E. of Greenwich.
Latitude	of the Observatory	° 13	′ 4	″ 8,5	N.

In addition to which I might now swell this list, by giving the particulars with regard to observations made of Halley's Comet—the occultation of stars and planets by the moon—the transit of Mercury over the sun'a disc——observations made during the hot land-wind, compared with those made at other times, &c. &c.—all of which, although eminently tending to advance the cause of Astronomy, would, nevertheless, increase this article to a length which would be considered tedious, and beyond that which I had intended at its commencement.

I will therefore further notice two points, only, which have been canvassed in the Madras Results. The first is the annual parallax of *a Aquilæ.*

If an observer, situated at any fixed star, were to measure the subtense of the diameter of the earth's orbit, by an easy trigonometrical computation, we should at once arrive at a knowledge of the distance of the said star; but if, as generally has been supposed, the earth's orbit, 190,000,000 miles, subtends no appreciable angle, in this case the distance of the star falls short only of infinity.

The star in question (*a Aquilæ*) has, with several others, engaged the attention of those Astronomers who possess the means of making observations of this nature, from the earliest times; and, in proportion as the means for obtaining an accurate result have increased, just in that same ratio has the assigned quantity of parallax diminished.

On one occasion, the Astronomer Royal of Dublin obtained the gold medal of the Royal Society, for having detected in *a Aquilæ* an annual parallax of two or three seconds; and, in the succeeding year, the Astronomer Royal at Greenwich obtained the same medal for proving that *such was not the case.*

It would be disingenuous here to offer an opinion upon the *modus operandi* pursued by these individuals, (on which the result mainly depends). I will therefore proceed to state, that the Dublin results have been completely confirmed by the Madras Observations; the annual parallax amounting to 1·96, giving the distance of this star from the earth 19,104,200,000,000 of miles.

Lastly (since it is the last result obtained from the Madras Observations), we will examine the determination of the *proper motions* (as they are called) of the fixed stars.

By reason of refraction, and the earth's motion in its orbit, combined with the velocity of light, the distance of one fixed star from another, as measured by astronomical instruments, is continually liable to change; and, in the case if stars situated so near the *Earth* as *a Aquilœ*, a further cause of change is found. When these *known* variations are computed and allowed for, if the place of the star from year to year does not conform to the known variations of its place, it follows, either that the star must have some motion of its own, or that its place has changed from a movement of our system. In either case the amount

would be called *proper motion*, but, for distinction sake, I propose to introduce the terms *true* and *apparent*.

Now the *true* proper motion of several of the (improperly called) fixed stars, has been long since recognized, and the *apparent* has been talked of as possible, but has not yet been established. With a view to enquire into this question, I selected a large catalogue of stars for observation, about two years ago, a great many of which have already been observed; whence it appears, that, out of 3,003 stars, there are 135 which exhibit *true proper motion* in right ascension, and 128 in declination. The remaining stars having (if any) but a very small *proper motion*.

To understand this the better, it will be as well here to explain, that the places of the stars, from the Madras observations for the year 1835, have been compared with the places determined by Piazzi for the year 1800; the difference between these places being divided by 35 (the numbers of years elapsed), gives the annual *variation* of each star; the difference between which and the computed annual precession, leaves the proper motion. It happens, however, that (each observer having committed an error, more or less, in each observation) the amount of *proper motion*, thus determined from any single star, will be mixed up with the accidental error of observation. Hence it will follow that all the *proper motions*, which are less than the possible errors of observation, may be in reality the error of observation, and not *proper motion*. This is true, as I have already said, for a single observation, but, from the mean of a great many, we may hope much to reduce, if not to get rid of, the error of observation.

It will hence be understood that the 135 cases of *proper motion* in right ascension, and128 in declination, above mentioned, are those cases in which the difference between the variation and the precession exceeds the largest amount to which the error of observation reaches. On looking over these proper motions, they occur so indiscriminately, among bright or faint stars, as often + as —, or at one part of the heavens as frequently as at another; so that we at once must set them down as *true proper motions*.

With regard to the remaining 2,868 stars, which exhibit proper motion, *below* the value at which we have rated the error of observation in right ascension, and the 2,875 cases (under ths eame conditions) in declination, should these too occur indifferently, + or — &c., it would follow that, whilst taking the mean to get rid of the error of observation, we shall at the same time get rid of the *proper motions*. If, however, the proper motions arise from motion of the solar system, the quantities we determine will be *apparent* proper motion, and, taking the stars at various part of the heavens in groups, the effect would (all having the same tendency) accumulate. With this in view, the means have been taken in every hour of right ascension as follows:

MEAN OF THE PROPER MOTIONS.

Right Ascension.				Declination.			
Hour.	P.M. Stars.	No. and sum of + and − P. M.	Mean −,0057*	P.M. Stars.	No. and sum of + and − P. M.	Mean.	Corrected mean.
		s.	s.		s.	s.	s.
0	7	60= +0,912 11= −0,077	} +,0061	5	29= + 0,99 43= − 3,73	} −,0381	+,0036
I	8	87= +1,081 15= −0,109	} +,0038	2	48= + 2,28 60= − 5,37	} −,0286	+,0131
II	7	61= +0,661 37= −0,318	} −,0022	7	37= + 2,51 61= − 5,97	} −,0353	+,0064
III	4	69= +0,701 28= −0,177	} −,0003	7	41= + 1,90 62= − 5,03	} −,0304	+,0113
IV	5	95= +0,928 26= −0,175	} +,0005	5	51= + 3,19 70= − 6,36	} −,0262	+,0155
V	2	116= +1,009 28= −0,201	} −,0002	3	53= + 3,96 74= − 6,99	} −,0239	+,0178
VI	9	122= +1,185 32= −0,240	} −,0004	10	72= + 4,56 79= − 7,61	} −,0202	+,0215
VII	7	123= +1,154 23= −0,166	} +,0011	5	59= + 2,96 89= − 7,49	} −,0306	+,0111
VIII	3	79= +0,918 31= −0,280	} +,0001	2	30= + 1,70 76= − 6,31	} −,0435	−,0018
IX	6	73= +0,709 30= −0,189	} −,0007	3	31= + 1,36 75= − 5,55	} −,0395	+,0022
X	7	84= +0,907 29= −0,276	} −,0001	2	39= + 1,55 79= − 8,19	} −,0563	−,0146
XI	7	97= +1,128 41= −0,348	} ,0000	6	28= + 1,45 92= − 8,64	} −,0599	−,0182
XII	4	105= +1,301 13= −0,091	} +,0046	3	51= + 3,47 87= − 8,14	} −,0338	+,0079
XIII	2	105= +1,086 32= −0,244	} +,0004	2	46= + 2,57 90= − 7,45	} −,0359	+,0058
XIV	4	98= +0,969 33= −0,195	} +,0002	5	41= + 1,91 90= − 8,13	} −,0475	−,0058
XV	4	82= +0,846 18= −0,146	} +,0013	3	31= + 2,36 72= − 6,27	} −,0380	+,0037
XVI	0	85= +0,721 48= −0,358	} −,0030	6	38= + 1,94 95= −10,41	} −,0637	−,0220
XVII	3	82= +0,754 39= −0,280	} −,0018	10	32= + 1,25 76= − 8,27	} −,0650	−,0233
XVIII	5	81= +0,718 22= −0,185	} −,0005	4	31= + 1,73 76= − 8,42	} −,0625	−,0208
XIX	4	97= +1,005 24= −0,186	} +,0011	4	33= + 1,90 80= − 8,20	} −,0558	−,0141
XX	10	97= +1,150 16= −0,117	} +,0034	5	43= + 3,03 85= − 9,12	} −,0476	−,0059
XXI	5	96= +1,227 12= −0,104	} +,0047	2	33= + 1,50 78= − 7,76	} −,0564	−,0147
XXII	13	89= +1,047 11= −0,049	} +,0041	4	45= + 2,43 67= − 5,85	} −,0354	+,0063
XXIII	9	94= +1,259 13= −0,101	} +,0051	3	43= + 2,59 70= − 5,58	} −,0265	+,0152

* A reduction due to our having reckoned from a different equinoctial point.

On examining the column "*Mean*" for the right ascension, it will probably be remarked that the ten thousandth part of a second of time, or even the thousandth part, is a quantity over which our observations can possibly exercise no control. In anticipation of such a remark, I have computed, that the *probable* error of each of the above values =,0006 *and the most probable largest amount of error* =,0023*s*. If we now re-examine the column "*Mean*" for right ascension, recollecting that any or each result *may* be erroneous to the amount, 0023, we find that something remains to be accounted for. On examining the column "mean" for declination, a general determination towards the *minus* sign shews that some error exists in the assumed latitude, either of Palermo or Madras, or in both, to the amount of 1,46*s*. Here, too, it might be remarked, that the observations cannot possibly take cognizance of the ten thousandth part of a second of space,—on computation, I find the most probable largest amount of error =,"0102. If we now reduce the column "mean" by the correction ,"0417 on account of the error of latitude, we obtain the column "*corrected mean.*" Examining this column, recollecting that errors to the amount ,"0102. *may* exist in any of the results, we again find, as in the case of the right ascension column, that something remains to be accounted for.

It would not be wise here, to endeavour to reduce the numbers in either column to regularity (by attributing to them errors within the above found limits), and to proceed upon such regularity to establish the law of change, and then to shew that such law can be explained by such and such a cause, &c. No—the plan is, to continue the observations to a larger number of stars, and allow the observations themselves to point out the law, in a manner which will not admit of doubt.

The above results are derived from the observation of 3,003 stars, during the years 1834 and 1835, in addition to which, I shall shortly (in a year and a half from the present time) be prepared to encounter the enquiry, with a further catalogue of five thousand stars, when the cause of this now seeming anomaly will, I have no doubt, be satisfactorily explained.

IV.—*Observations on the Flora of Courtallum.—By* ROBERT WIGHT, Esq. M. D.—*(continued from Vol. 3d page 96.)*

VII.—*Capparideæ.*

This is a large and almost exclusively tropical Order, a few species only being found in the temperate zones, while they every where abound within the tropics. It divides itself into two very distinct sections, the *Cleomeæ*, or genera with herbaceous stems and capsular fruit; and the *Cappareæ*, with shrubby stems and fleshy fruit. Of this Order, De Candolle describes 230 species; Wallich in his list of Indian plants has named 42 species, 35 are found in the Peninsula, 14 in Senegambia, and 10 in Java. Of the 35 Peninsular species I have 10 from Courtallum. This falls greatly short of the actual number belonging to that Flora, many of the more common ones having been neglected.

Bearing in mind the characters of the class *(Thalamifloræ)* to which it belongs, species of this order are, usually, readily distinguished by their reniform seeds, and long pedicel of the ovary and fruit. This last mark, however, from not being constant, especially in the herbaceous species, and from being also common to the *Passifloræ,* to which this order is related in some other points of structure, is of less value, as an essential distinguishing character, than the former. Most of the shrubby *Capparideæ* are furnished with rather handsome flowers; some have them very large. One, a scandent species, I recently found in Ceylon, has the stamens fully three inches long: the rest of the flower being large in proportion, and pure white, forms a very conspicuous object, and, contrasting strongly with the surrounding foliage, can be seen at great distances, decorating the clumps of jungle among which it grows.

In an economical point of view, this Order is of very secondary importance, a few only of its species being held in esteem. The principal of these is the *Capparis spinosa*, the young flower buds of which, when pickled, afford the well known capers of commerce, and, I dare say, several of the Indian ones might be similarly employed. The one most nearly allied to the European plant, is our *Capparis horrida*, but, owing to the buds being usually covered with a rusty coloured down, they might not answer quite so well for pickling.

Polanesia (cleome) icosandra, one of the herbaceous forms, is said to be so acrid as to raise blisters, when the bruised leaves are applied to the skin, and the seeds, it is added, are employed like mustard as a condiment. The leaves of some of the other species are eaten, when stewed, or boiled, like spinach.

VIII.—*Flacourtianeæ.*

This is a small Order, most of the species of which are tropical; two or three, only, are found extending to the Cape of Good Hope, and one

to New Zealand. De Candolle describes 26, and Wallich's list of Indian plants contains 12 species; seven of which are natives of the Peninsula, and two have been introduced. To these I have added two or three from Courtallum, and suspect the existence of two or three more, of which, however, I have not yet found the fructification, to enable me to determine with certainty. Among those from Courtallum, there are several species of *Phoberos*, an old genus, first found in Cochin China, since on the Neilgherries, Ceylon and Cape of Good Hope, but not mentioned, even as a synonym by De Candolle.

The essential character of the Order is, having a one-celled ovary with parietal placenta; the flowers vary so considerably, in different genera, that no good general character can be derived from them. Nearly one half of the genera have flowers without petals, some are dioicous, or monoicous, while *Phoberos*, and some others, have them bi-sexual. In habit, they are all trees or shrubs, many of them armed with large strong thorns. Two of the Courtallum species of *Phoberos* are considerable trees, and *Hydnocarpus*, both there and on the Malabar Coast, often attains a large size.

Of the properties of *Flacourtianeæ* little is known. Some species of *Flacourtia* bear an agreeable sub-acid fruit, from which excellent preserves are made. *Hydnocarpus Venenata*, on the other hand, bears a fruit highly poisonous to fishes, which, on eating of it, become so unwholesome, as to be unfit for food.

The seeds of *Bixa Orillana* (which has recently been restored to this Order by the authors of the *Flore Senegambie*) are enclosed in a brownish coloured pulp, from which the dye called *Arnotto* is procured. This substance, which possesses some very curious chemical properties, is said to be stomachic and slightly purgative.

I have not been able to ascertain the quantity of *Arnotto* annually consumed in England, nor the method of using it as a dye, but, if the former is considerable, a large supply might be procured from India, as it grows luxuriantly, producing abundance of fruit, wherever planted in a good soil: being a handsome ornamental shrub, it is frequently met with in gardens. The dye is used for staining cheeses, as well as colouring cloth.

IX.—*Violarieæ.*

This is a large but principally extra-tropical Order. Dr. Wallich has named 18 in his list, sixteen of which are Indian plants, the other two from Penang: he seems however to have unnecessarily multiplied species. Six only are referred to the Peninsula, three species of *Viola*, and three of *Ionidium*: two of the former are from the Neilgherries, and one from Mysore, and closely resemble some of the European forms; the latter are natives of the plains and sub-alpine districts. Two of the latter I have found at Cour-

tallum, as yet none of the former. Four of the six are I believe natives of Ceylon, and found in similar situations: the species of *Ionidium* are very widely distributed over India, extending from Cape Comorin to Delhi, but, unfortunately, so far as it is yet known, are of no value in an economical point of view. Many of the American, and some of the European, species, possess emetic properties, and are used as substitutes for ipecacuanha.

X.—*Polygaleæ.*

A large Order found more or less copiously distributed over nearly the whole globe. Dr. Wallich has named 31 species in his list, some of which, however, are natives of the Eastern Islands. Fifteen are described in the Peninsular Flora, to which I have since added five new ones, namely; one *Polygala*; one *Salomonia*, forming an additional link between the Floras of the Peninsula, Ceylon and China, in which countries, only, this genus has yet been found; and three species of *Xanthophyllum*. The last are all from Courtallum. Of the genus *Polygala* I have only three species from Courtallum, owing to their being generally found on the plains, while my collections are principally alpine. Blume describes seven species from Java, referable to three genera. The authors of the *Flore Senegambie* have three from that country.

In a botanical point of view this Order is interesting, as affording a good example of unsymmetrical flowers. The normal, or regular, form of a flower, is to have, say, 5 sepals, 5 petals and 5, 10, 15, &c. stamens, or the sepals, petals and stamens, regular multiples of each other. In place of this arrangement, we find in *Polygala* a calyx of five sepals, the two lateral ones petaloid, and much larger than the other three (they are usually called alœ or wings in the generic character); a corolla of three petals, the claws of which are usually united at the base, forming a single tubular three cleft petal, the middle lobe of which is frequently furnished with a crest; and eight stamens united into two bundles. *Xanthophyllum*, except the stamens, returns to the normal form, having five sepals and five distinct petals, but only eight stamens, six of which are opposed to the petals, in place of having ten, the normal number, opposed alternately to the sepals and petals. This irregularity of structure has caused much diversity of opinion among botanists, as to the place the Order should occupy in the natural series; a subject which it is unnecessary to discuss here.

With the exception of a few species, little is known regarding their economical properties. The roots of most are milky, and the leaves bitter. *Polygala Senega*, an American plant, has a variety of valuable properties attributed to it, and, in this country, the roots of several are said to be antidotes to snake bite. The fresh root, bruised and applied to the part, is a remedy on which I should not feel disposed to place

much reliance in such a case, and still less on holding a piece of it in my hand, as a means of preventing snakes biting me. The natives however, I am informed, believe that it possesses this last property. What possible accidental coincidences could have given rise to such a strange belief? *Xanthophyllum virens* is a large timber tree, the wood of which, we are informed by Dr. Roxburgh, is remarkably hard and very useful to the natives of Silhet.

XI.—*Elalineæ.*

XII.—*Caryophylleæ*

The Courtallum Flora presents very few species of these Orders, and those of little interest under almost any point of view. I shall therefore pass them over and proceed to the consideration of

XIII.—*Malvaceæ.*

This is a large and, in many respects, an important Order, from the number and variety of products, useful to mankind, it affords: among which may be enumerated, food, clothing and medicine. Its species are found widely distributed over the tropical and temperate zones, but disappear as we approach the frigid. Within the tropics, they are estimated by Humboldt to form $\frac{1}{50}$ part of the flowering plants, an estimate, rather falling short of, than exceeding, the truth.

In this Order both sepals and petals are usually five, both series more or less united at the base, the latter twisted from right to left, before expansion (œstivation twisted) and often adhering to the tube of the filaments; filaments usually united into a tube *(Monadelphous)* enclosing the styles; anthers *one celled*, ovarium single, but formed from the union of several carpels round a common axis, either coherent or distinct, each furnished with a style, which however sometimes unite into one, the stigmas only remaining free. These unions of parts, which are sometimes very troublesome in practice, are effected by nearly the same means that produce union between branches in the operation of grafting, namely, approximation of parts and pressure, during the development of the flower.

Viewed in its economical relations, this is by far the most important Order we have yet had to consider. The uniform character of its species is to abound in mucilage, and to be totally destitute of unwholesome qualities. The emollient qualities of marsh mallows are known to every one, and may almost be taken as a type of the medicinal properties of the whole Order. Many of the species are used as food; sometimes the fruit, as the *Bendakai, (Abelmoschus, Hibiscus, esculentus)* is the part eaten; sometimes the leaves, as the *Poolchie Keeray, (Hibiscus Cannabinus)*; more rarely the involucrum and calyx, as the *Rozelle (Hibiscus subdariffa)*, so much prized in this country as a tart fruit, and for the pleasant sub-acid jelly procurable from them.

To the arts this Order largely contributes. The *Portia* tree (*Thespesia, Hibiscus, populnea*) affords an excellent, very close-grained, wood, used by the natives for making cart-wheels and, not unfrequently, by Europeans for gun-stocks. For the latter purpose it is not much inferior to walnut, but is not easily procured of sufficient size, owing to the trees being generally hollow or bad in the centre.

This last defect is, I suspect, mainly attributable to the almost constant practice of propagating it by cuttings from large branches, in place of raising it from seed or small cuttings. In the first case, the branch planted dies and rots out, leaving only the new wood, that has been deposited on its surface in after growth.

It is a curious fact in vegetable physiology, that many plants, which have been much propagated by cuttings, or otherwise than by seed, seem to lose the power of producing perfect seeds. This is remarkably the case with the plantain, which, in the cultivated state, is never known to ripen its seed, while in the wild, it does so readily. In the same way the *Portia* has nearly ceased to produce seed in this country, though it always bears abundance of flowers, and looks, in all other respects, healthy. This remark, it appears to me, is deserving of attention, as there is reason to fear, if steps are not taken to prevent it, the tree will, ere long, cease to yield useful timber. The *Plumieria alba*, or *Araleepoo*, affords another still more striking exemplification of this position, as I have not once seen its fruit, although in flower at all seasons, I have no doubt from the same cause.

Among the herbaceous *Malvaceæ*, many species produce fine fibres of great tenacity, well fitted, if more care was bestowed on their preparation, to be employed as substitutes for flax and hemp. The *Hibiscus cannabinus* is more cultivated for the hemp-like fibres of its bark, than as a pot-herb. These are, now, only made into an inferior kind of cordage, or wove into coarse cloth, but, if more carefully prepared, might, I believe, be made into much finer, and more valuable, fabrics. But by far the most valuable genus of the Order is *Gossipium*, or the cotton plant, the different species of which are so extensively cultivated in all the four quarters of the globe, on account of the woolly fibres which envelope its seeds.

There are but few plants, if indeed there is another in the whole vegetable kingdom, to which mankind is indebted for so many of the comforts and luxuries of life, as this; and it is certainly the source, to which Britain, more than to any other, owes her greatness, as a manufacturing and commercial nation. The great demand for cotton, to supply her manufactories, has given a stimulus to every branch of productive industry, such as, half a century ago, could scarcely have been supposed possible. These vast establishments now annually consume nearly 130,000 tons weight of cotton wool, in the fabrication of all descriptions of piece

goods, and give employment to some hundreds of ships for supplying them with the raw material, and re-distributing their manufactured produce, to almost every part of the habitable world. For the navigation of these ships, some thousands of mariners are required; to build and keep them in repair, many thousands of artisans. Add to these, upwards of a million and half of persons, employed in making, and superintending the working, of the manufacturing machinery, and then, we may be able to form an estimate, but I fear an imperfect one, of the value of this branch of industry to Great Britain—a branch, which considered in this comprehensive point of view, we may safely affirm gives direct employment to upwards of two millions of British subjects. When to these benefits, which the British nation almost exclusively derives from the mere manufacture of the produce of this humble shrub, we add those which it confers on the countries from which it is procured, by affording a livelihood to many millions of persons, of all conditions and ages, occupied in its culture, and fabrication into cloth for home use, and from these data, attempt to estimate its value to mankind, the subject becomes too vast for the grasp of human intellect.

Much has been said and written, on the effects of machinery in improving the condition of mankind, too often, it is true, at the expense of great present suffering to the labouring classes, whose occupations it had superseded. I know no instance more in point than India now affords. We learn from history, that the cotton manufacture originated in India, upwards of three thousand years ago. From that time to the beginning of the present century, she may almost be said to have held the monopoly of this branch of industry; so far, at least, as muslins and the finer sorts of cotton fabric are concerned. The Hindoo weaver skilful, from long practice, in the use of his simple implements, and having no competitors, did not think it necessary to tax his ingenuity, for the invention of new and improved spinning and weaving machinery, but went on, as his progenitors had done, spinning and weaving, with a wheel and loom still of the simplest construction.

The process of fabrication, by such primitive methods, is so slow, that a man and his family, in constant employment, can do little more than support themselves by their labour. When, on the contrary, the raw material is exported at heavy cost to Britain, and manufactured there, with the aid of improved machinery, it can be brought back and sold, after paying the expenses of a second voyage, from 20 to 30 per cent. under the produce of the same quality of the native loom. Owing to this difference, when the trade was thrown open, and free access was allowed to British manufactures, their cheapness soon drove the Indian ones out of their accustomed markets, and caused at first great distress to our manufacturing population. Now, however, the scales are re-adjusting themselves to our altered circumstances, and the advantages of the

change are becoming evident. The exportation of piece goods, from the comparatively small quantity that could be produced for exportation, and the great expense of fabrication, never could return a proportional, if even a remunerating, profit to the country. The raw material, on the contrary, owing to the unlimited demand, the comparatively high price which it bears, and the small expense of preparing it for the market, not only renumerates, but returns such a profit, as to stimulate to a vastly increased production ; when we add to this, that our growers can now clothe themselves with English cloth more cheaply than they formerly could with native, we can at once appreciate the advantages which India is in course of deriving from the English cotton manufactories ; and how much her future prosperity must depend on the extension and improvement of her cotton cultivation. The fulfilling of these conditions is, in truth, indispensable to a continuance of that commercial prosperity, which is now beginning to dawn on us ; since, unless we labour diligently to improve the quality, and diminish the exportation price of our cotton, great as the demand now assuredly is, we can scarcely expect that it will be able to hold its present place in the English market, when opposed by so many competitors, and, still more, by the long and expensive voyage required to bring it into that market.

This is not the place to enter on the description of the methods of cultivation, but I may mention, generally, that the soil of much of the Peninsula is well suited for raising some of the finer kinds of foreign cotton, such as the Bourbon and American green seed cottons. Those soils in which the former thrives best, at least in the Tinnevelly district, are light, loose and sandy, of a deep rusty red colour, and largely impregnated with iron ; for the latter, dark soils, of a loose and friable description, from containing a considerable admixture of sand, and that have formerly been under wet cultivation. To do the plants justice these should be ploughed with a deeper furrow than is usual in Hindoo agriculture, to allow of free access to the depth of at least a foot to a large descending, or *tap*, root with which it is furnished. The sowings are generally commenced near the end of the rains ; it would be better if they were done earlier, to allow the plants time to attain nearly their full size, before the hot dry season set in. This is of consequence, because it is the check which it then receives, that determines to the formation of flower buds, which by being delayed till this more advanced stage, would probably be productive of larger crops and better cotton. Cropping the ends of the young shoots, at this time, would still further lead to the same effect; by stopping the too rapid flow of the sap, and favouring the concentration of the secretions, and thereby the formation of flowers and fruit. I mentioned, at the conclusion of my last paper, the tendency of extreme luxuriancy of vegetation to cause sterility. This is frequently the case with cotton ; hence the almost con-

stant failure of attempts to cultivate Bourbon and American cottons, on what is called the *black cotton soil*; its extreme fertility causing them to run to wood and leaves, and produce no flowers. So different is the indigenous Indian cotton, in this respect, that on the red soils it gives both inferior crops, and cotton of inferior quality, and attains its greatest perfection on the black. Pruning the extremities of the young branches, is extensively practised in some countries, where the plant has been long and very successfully cultivated. Some practical writers however object to this practice, they say, as the result of experience, but, as the experiments made to prove this position, are not detailed with sufficient exactitude, to enable me to determine their value, by an examination of the circumstances that might have an unfavourable effect on the result, and as they are at variance with the principles of vegetable physiology, I feel disposed to doubt their accuracy. As this is a practical question of great importance, and one which can only be set at rest by a series of carefully conducted experiments, I must, for the present, leave it in the hands of those who enjoy opportunities of examining it in that manner, and shall feel much indebted to any one who can give me practical information, on this, or on any other, point connected with the cultivation of cotton.

I have been induced to enter, thus largely, on the consideration of subjects connected with the cotton trade, for the sake of showing the advantages India is already reaping from her, as yet comparatively limited, engagement in this branch of commerce, and of calling attention to the much greater ones she may expect to flow from it, as the rewards of industry and attention to increase the quantity, and improve the staple, of the article which forms its basis, in the hope of inducing practical men to lay the results of their experience before the public, for the guidance of their less informed neighbours. As there are but few Europeans engaged in this culture, I more especially address myself to intelligent and well informed natives, many of whom are readers of this Journal, and, among whom, I feel assured there are many, both able and willing, to furnish much really useful information, acquired during a series of years devoted to agricultural pursuits, but who are kept back, either by supposing that they have nothing new to communicate, or from a distrust in their qualifications to reduce, to a suitable form for publication, the results of theire xperience. To all such, the writer of these memoranda offers his assistance, and, in the hope of more rapidly extending our knowledge of cotton culture, as well as forwarding the wishes of government in the improvement of our commerce, will, with pleasure, charge himself with the task of correcting for publication, all really practical communications that may be addressed to him.

The following are some of the points on which information is wanted: —What is the depth to which the soil should be turned, by ploughing or digging, for cotton cultivation? What are the advantages or disadvantages of sowing in rows as compared with broad cast? Would sowing during the earlier periods of the rainy season, be productive of larger crops, or improve the staple of the cotton? What are the effects of cropping the top shoots about the time of flowering? In Spain, and the Islands of the Mediterranean, where cotton has been long cultivated, and generally in America, the ground is turned to the depth of ten or twelve inches or more, in this country, rarely to half that depth. In these countries the row system is usually adopted, and a regular interchange of seed practised, it being observed, that the crops deteriorate both in quantity and quality, when this is neglected. In this country both practices are almost unknown. The question of the best time for sowing is a local one of season, and must be determined by comparative trials, made in the same field, and on plants placed, in every other respect, in the same circumstances. That of cropping must, in like manner, be determined by comparative experiments on plants placed, in every respect, in similar circumstances. With respect to this operation, I may repeat that, as the object of it is to retard the two rapid flow of the sap, and favour the concentration of the secretions on which the formation of flowers and fruit depends, it is essential to its success, that it be done in very dry weather, and on clear days (exposure to bright sun-shine prevents bleeding); consequently the state of the weather should be noted,in connection with details of experiments illustrative of this branch of the enquiry.

XIV. *Bombaceæ.*

This is a small Order, consisting principally of tropical trees and shrubs, confined, however, with a few exceptions to America, and the West Indies. It is very closely allied to the preceding, from which it principally differs in the form of the calyx. In this the sepals are united at the base, forming a tube, the divisions of the limb are not truly valvate as in the other, and the stamens are, usually, polyadelphous, not monadelphous. The Indian flora boasts of but few, that of the Peninsula of only four indigenous species, and one of these imperfectly known. Two of the Peninsular species *Bombax Malabaricum* and *Eriodendrum anfractuosum*, are large trees, the wood of which is light and spongy, well fitted for making catamarans and rafts. An astringent gum resin is yielded by the former, "which, as well as the young roots, called *Mooslee suffed*, are considered very strengthening in Bengal."* Neither are mentioned by Ainslie, but he speaks of the gum of the latter (*Bombax pentandrum*)as being administered in certain stages of bowel

* Royle.

complaints, in conjunction with spices. The seeds of both are clothed with silky cotton, whence they are usually called cotton-trees, but must not, on that account, be confounded with the *Gossipium arborium.* The cotton, being unfit for spinning, is only used for stuffing cushions, for which it is well fitted, by its property of not readily becoming matted into hard lumps like the true cotton. The Baobab or Ethiopean sour gourd tree (*Adansonia digitata*), is now naturalized in India. It is remarkable for the immense thickness of its trunk—trees, thirty feet in diameter, it is stated, being occasionally met with in Africa. I have myself measured trees in this country nearly forty feet in circumference. " Adanson, during his visit to Senegal, has given a full and interesting account of this tree, and, certainly, not the least striking circumstances respecting it are, its enormous size, and its great age, whence it has been called *arbre de mille ans*, and whence, too, Humboldt has been led to speak of it, as the oldest organic monument of our planet. Its trunk, indeed, great as is its diameter, has a height by no means proportionable to its breadth. Adanson calculates as follows: That a tree of

1 year old is	1 inch or $1\frac{1}{2}$ inch diameter,	5 inches in height.
20	1 foot	15
30	2	22
100	4	29
1000	14	58
2400	18	64
5150	30	73

" The leaves, dried and reduced to powder constitute *lalo*, a favourite article with the natives, and which they mix daily with their food, for the purpose of diminishing the excessive perspiration to which they are subject in those climates, and even the Europeans find it serviceable in cases of diarrhæa, fevers, and other maladies.

" The fruit is, perhaps, the most useful part of the tree. Its pulp is slightly acid and agreeable, and frequently eaten; while the juice is expressed from it, mixed with sugar, and constitutes a drink which is valued as a specific in putrid and pestilential fevers. Owing to these circumstances, the fruit forms an article of commerce." (Hooker's Bot. Mag. No. 2791).

Helicteres isora, a shrub widely distributed over India, is interesting on account of its curious spiral seed vessel, somewhat resembling a screw, and on that account supposed by the natives to be useful in pains of the bowels. The *Durian* tree, a native of the eastern islands, is remarkable for its fœtid but pleasant tasted fruit.

V.—*Remarks on the Vegetation of the Neilgherries.—By Captain* JAMES ALLARDYCE, *of the 23d Regiment Madras Light Infantry.*

The object of the following remarks, is rather to offer a few general observations on the hill vegetation, than to give a systematic description of the Flora.

The climate of the Neilgherries has been often described, and nothing need be mentioned on that head, further than to notice that the theory, by which it is maintained that isolated hills are cooler than table-lands of like elevation, is to be adopted with certain limitation, for many hills on the skirts of the Neilgherries, higher than Ootacamund, are yet not so cool by many degrees. The accession of warm air, from the plains, seems to be the cause of this: it affects the temperature for some distance round the margin of the plateau, while Ootacamund, being near the centre, is protected from it, by an intervening space of several miles. This, however, has its limit, and, if the Neilgherries were considerably more extensive, the causes would come into operation, that affect the temperature of entire countries highly elevated above the level of the sea, such as the plains of Tartary. Table lands, therefore, when of a limited extent, appear to be cooler than isolated peaks of equal height.

The appearance of the Neilgherry thickets must surprise every one, who visits the hills for the first time, composed, as they are, of trees densely covered with permanent foliage, and of an outline so even, as to suggest the idea of its having been artificially produced. These, and the smooth dome-shaped hills, are the two principal features of the Neilgherry landscape. Singular as the vegetation may appear, it is still not unique, or confined to that particular locality—indeed, it would be contrary to analogy and all experience, to infer that a separate Flora could have its limits within so short a space. From an enumeration of the species, we are led to suppose that many of the plants are the same as those of Europe; but this is not so much the case, as would at first appear. Many species are referable to genera common in Europe, which still have characters peculiar to the Asiatic species of the genus. There are, however, a few plants quite identical with those of Europe; among which may be mentioned a few *Cruciferæ*, and one or two grasses, such as the *Festuca rubra,* the common English grass, but it occurs only as a domestic plant, in the vicinity of the villages, where it is fast gaining ground, and has already displaced the indigenous grass.

Although many plants may be found on the Hills, that are also common to the mountains of the north of India, still the absence of *Coniferæ, Amentaceæ,* and deciduous trees in general, separate the Flora at once from that of Nepal, or the Himalayan mountains.

The trees most prevalent on these Hills, are of the natural Order *Myrtaceæ*, including three or four species of *Syzygium* and one *Myrtus*: these, with the *Rhododendron*, constitute about one half of the timber trees, the total number of species amounting to upwards of a hundred. The *Syzygium* has the power of throwing off its petals while the flower is expanding; a character quite eastern, found at its maximum in the numerous genus *Eucalyptus* of New Holland. When it is considered that the *Myrtaceæ*, *Laurineæ*, *Melastomaceæ* and *Loranthaceæ*, are abundant on the Hills, as well as in other parts of the line of ghauts, it will not be unreasonable to compare the Flora directly with that of the Eastern Islands, passing over the intermediate plains. They have many plants in common, and whoever has had an opportunity of making the comparison, must be struck with the close resemblance. It would be desirable to ascertain this point more fully, as it in some degree concerns the geology of India.*

A singularly rich and beautiful vegetation prevails, within a certain compass, to the eastward; this space may include the islands of the Eastern Archipelago, and the southern part of the Asiatic continent. Independently of systematic distinctions, one invariable external character or aspect belongs to the trees of these islands—an exact regular outline, a rich foliage, remarkable for its density and brightness of colour, being entirely evergreen, generally coriaceous, though sometimes membranous, but, in either case, persistent throughout the year, and highly coloured on first unfolding. These circumstances give an expression of great beauty and elegance to the woods of the eastern islands. The *Loranthus*, and other parasitical plants, abound on the branches, and the richness of their coloring exceeds that of the trees themselves. Ferns, also, are in profusion, at the level of the sea, growing to a great size on rocks, walls and the boughs of trees; some of them, of a twining habit, reach a height of twenty or thirty feet. This vegetation does not appear to continue far to the eastward; in the direction of Australia it has ceased; there the species are of a different character, and the foliage is remarked as being lax, straggling and of dull colour. To the westward, also, there are few traces of this vegetation, even at so short a distance as the Coromandel Coast: on the Malabar side, however, there is, and the *Santalum*, *Ixora*, *Eugenia*, &c. are quite characteristic of the Malayan Flora. The Neilgherries have a vegetation strongly resembling that of the Indian islands, even at the ordinary levels, but it is to the lofty mountain ranges of Sumatra that

* For example, it is about the latitude of the Neilgherries or Nowera Ellia, that we might expect the divergence of a great connecting cross chain, corresponding with the Himalayan and Vindyha range, and such a range as this may have been at one time above water, connecting the Peninsula with the more easterly ridges.

we must look for the identical species of the Hills*; at the height where the *Rhododendron* flourishes, these will no doubt be found, together with many others inhabiting a similar climate, that have not found their way to Ceylon or the western ghauts.

It is probable that the islands will be found to possess a richer Flora than the Peninsula, and it is to be regretted they have been so little explored. Singapore, alone, contains a vast number of undescribed species, and, in the neighbouring islands, there is a like variety. If these individually contain a variety of plants, equal at all to that on the Malabar Coast, or if we consider the Malabar plants as a detached portion of the insular Flora, it would be difficult to fix a limit to the probable number of species, that might be comprehended in a complete herbarium from the Archipelago.

Although the vegetation on the hills is generally of the insular character, it is not by any means exclusively so; the *Gnaphalia,* on the contrary, have the appearance of African plants; and the same may be remarked of the gigantic *Solanum* and *Crotolaria.*

Of the geographical distribution of plants, in general, much is not at present known. It is a theory that will be better understood, when collections are more complete, but, as a study, it is interesting, and likely to be attended with discoveries important to science. Many plants are almost universally distributed, such as the grapes, which are found in all climates; but others have a very decided line of demarcation. The genus *Pelargonium,* or geranium, is confined to southern Africa, and *Rosa* to the northern hemisphere. *Erica* is not an American genus, yet is distributed very generally over northern Europe and southern Africa, where the species amount to several hundreds. These two localities of the heath, probably belong to the same area, which is partially interrupted by the intermediate tropical regions of Africa. Among the genera confined to America may be mentioned the *Cactus,* or prickly pear, which, though occurring in numerous species there, is not common to other countries. Supplying its place in Asia, we have the *Euphorbia.* But, of all places, Australia has the most marked indications of a methodical distribution. Plants there are not only of strange species, but they differ, in habit and aspect, from those found in other parts of the world. A certain number of the *Acaciæ,* for example, are leafless; when the plant has attained the size of a tree, leaves cease to be produced, and their place is supplied by the winged stipules. In this way a tree, that rises from seed with a pinnate, or doubly pinnate, leaf, completes the remainder of its growth, with foliage resembling a myrtle or willow. None of the Indian *Acaciæ*

* Dried specimens from the heights of Sumatra would be interesting, could they by any means be obtained.

appear to have this peculiarity. It is clear from this, that, in studying the geographical distribution of plants, the outward habit must be taken into consideration, as well as affinity of species*. By this rule, the plants of the Neilgherries will be found to approach nearer to those of Sumatra than any other.

An enumeration of the Hill plants is not intended, but the notice of a few may be here permitted. In ascending the Goodaloor ghaut, the first intimation we have of an approach to a temperate climate, is the occurrence of the Mysore raspberry, *Rubus lasiocarpus* by the way side. This species is common in many of the hilly parts of India, and must be familiar to most travellers. It is of trailing, or ascending, growth, like a bramble; the branches are covered with a white down and the berries are black. Two other species are found at a greater height; the *R. Wallichianus* and *Rugosus*, both also ascending shrubs, and the latter has a lobed leaf like a vine. At the summit of the pass the jungle assumes a new character. The trees are small and robust, different altogether from those of the plain, and the ground is covered with herbage that has an appearance quite alpine; the grass short and verdant, with mosses in abundance.

Among the herbaceous plants that first attract attention, are the *Anemone* and *Viola Wightiana*, the *Hedyotis Leschenaultiana*, with the *Potentilla*, *Exacum*, *Orchis*, &c. It is not until half way to Ootacamund, that the *Rosa Leschenaultiana* makes its appearance: it is a large climbing shrub, showy when in flower, but not of much value as a rose. Another sort, with red flowers, is found near Avalanche, but it can only be considered a variety, or sub-species. The young shoots are short, and the bark is not coloured as in the other, but it differs in no material point.

It is not likely that useful plants will be discovered; more may be expected from introducing the plants of other countries to the Neilgherries. Ornamental flowery plants are not numerous; but the evergreen trees are most remarkable objects. They have been whimsically, though not inaptly, called cauliflower topped; a term which exactly expresses the appearance of their foliage, terminating in a defined surface, either continuous, or broken into masses. Their economical value is not yet apparent, but, as ornamental evergreens, they are well calculated for the improvement of the scenery in Europe, where verdure, during the winter months, is so great a desideratum. Few of them would endure the climate of Britain, but the south of France would nearly suit them. As a general character, their blossoms are small and inconspicuous; it

* Distribution with regard to latitude and longitude is here intended; the other department of Vegetable geography—the "physical distribution" or situation as to soil, moisture, elevation and local temperature is almost a separate study.

is in foliage alone that their beauty consists. The *Rhododendron*, however, produces magnificent flowers, and may be said to compensate, in this respect, for the deficiencies of the rest. The *Michelia* is also a handsome flowering tree, but is not equal to some of the American *Magnoliaceæ*. One of the neatest trees is a species, apparently, of *Syzygium*, with a nearly round leaf; it is generally grouped in small clumps with the *Laurus* and *Arbutus*. These three seem hardy, and not injured by frost; their recently expanded leaves are beautifully coloured. The *Laurus* has a large fruit, with the seed nearly on the outside, approaching in character to *Anacardium*; there are besides two other species of the bay tree. The *Arbutus* is a curiosity, being at least 40 feet high and a stout forest tree. Two species of *Viburnum* are common, but they are inferior in appearance to their congener the *Laurustinus*. Among remarkable plants is the *Berberis Leschenaultii*, a fine evergreen shrub, with pinnate leaves of a bright shining green. Several other species, with the pinnate leaf, have lately been brought to England, from Nepal and California, and are in great request as ornamental evergreens. Another, the *Berberis tinctoria*, much resembles the common barberry; it is found in great abundance on the north side of the table land near Billicul, where, also, is to be found a neat species of *Carissa*, well adapted for low hedges, smaller than the *C. Carandas*, and larger than the *C. spinarum*, it differs from the latter in the leaf which is not conspicuously veined.

Among the few plants having showy flowers, are the *Sonerila*, *Osbeckia*, *Exacum*, *Kalanchoe* and *Pedicularis*. The *Kalanchoe grandiflora* is the plant that has been likened to a primrose, but it is a succulent under-shrub, of the natural order *Crassulaceæ*, bearing cymes of yellow scented flowers. Neither the *Primula* nor *Androsacea* are to be met with in the woods; the climate is not perhaps sufficiently alpine for the latter, but the former might be expected, if within reach, to keep pace with the *Viola* which commences even below the passes. The most truly alpine plant, hitherto found, appears to be a species of *Alchemilla*, near the summit of Dodabetta. The *Potentilla* resembles in flower the common *Tormentilla* of England, and is not to be compared with the *P. formosa* and *atrosanguinea* of Nepal. The *Exacum*, that covers the fields so profusely during November, is scarcely ornamental, but another species, near the western passes, is an interesting plant. The flower is large, of a white colour, tipped with blue; another similar species, or variety, occurs near Koonoor, of a blue colour throughout. The *Ranunculus subpinnatus* very much resembles the common crowfoot; another sort, the *R. reniformis*, is common in the swamps, and *R. Wallichianus* in shady woods. The *Anemone Wightiana* has a small white mellifluous flower, of the size of the wood anemone, but in foliage it resembles a crane-

bill; it occurs in two varieties. The *Hedyotis Leschenaltii*, also breaks into several varieties, with change of soil and situation, but in none of them is the variation so great, as in the *Myosotis scorpioides* of Europe.

Few ornamental plants have been brought from Europe to the Hills, but the whole that are cultivated in the British gardens might be expected to succeed; and, in addition, many from the warmer climates of the Cape, Peru, Australia and China. Large deciduous trees would not be an improvement, at least near Ootacamund; but the small sorts, as hawthorn, lilac and laburnum, would be desirable; the laburnum, especially, from the hardy nature of its seeds, would succeed much better, and might be more quickly multiplied than any other, while, as a valuable timber, it ranks with ebony and box. Ornament may seem but a secondary consideration; still it would not be altogether out of place in the vicinity of Ootacamund, where, with a little attention to planting and laying out the grounds, great effect might be produced with little trouble, and with the prospect of ultimate profit. Much might be done in this way, when the advantages of climate are so great, and an experimental arboretum might be formed with little difficulty.

One great improvement to the scenery of the Hills would be the introduction of firs: it is a singular fact, that, although Ootacamund is the very region in which firs would thrive, not one of the *Coniferæ* is to be found on any part of the Hills. In Nepal the firs appear to commence at an altitude of 6,000 feet, or about the level of Koonoor; the hills therefore would exactly suit them. The grandest firs are the Norfolk Island, New Zealand and Chilian, pines; but seeds of these could with difficulty be procured. The most readily obtained would be the several firs growing wild in Nepal; the cedar and firs of the Levant, also, would succeed perfectly well, and seeds might be safely and quickly conveyed by the steamer. But, if seeds were sent from Nepal by dawk, they might be depended on as quite fresh; small quantities would be sufficient, and, in this manner, plantations of firs might be rapidly extended along the lake, and lower grounds, at Ootacamund, where they would soon be found to surpass the indigenous trees in luxuriance of growth.

Other seeds might be sent from Nepal, that would be of consequence to the Neilgherries, but none more likely to succeed than the firs, and none perhaps would be found more useful. For purposes of building, they are quite adapted, and as firewood, should it become scarce, they are the best that could be used, and have the desirable recommendation of burning while green. The absence of firs of natural growth on the Hills, seems more owing to their (the hills) remote situation from the geographical area of the firs, than to any

other cause. The genus *Pinus* does not appear to be found far to the south of the Himalayan mountains, while the *Agathis* and *Araucaria* of the South Sea islands, do not come so far to the westward as Australia, their place being there supplied by the *Casuarina.* How far the dammar pine, *Agathis loranthifolia,* may prevail among the Indian islands is uncertain; those so called throughout the Straits of Malacca are various lofty *Dipterocarpeæ.* It is not clear, even, whether the *Casuarina* extends to the Straits: it may be seen cultivated there, and occurs in abundance along the northern shores of Sumatra, and the coast of Kedah, but there is reason to believe it has been introduced there, as well as at Madras.

It is not probable that the Neilgherries will ever produce, in abundance and perfection, the fruits of temperate countries, the climate and seasons being entirely at variance with the habits of deciduous trees. The only fruit likely to succeed is the orange, but the kinds already cultivated on the plain, are the worst to make choice of, as they have been long accustomed to a high temperature, and would not readily grow on being transferred to the Hills. The Portugal, St. Michael and Malta oranges, would, doubtless, come to perfection, and might be introduced even from seed, for the orange does not appear to degenerate so much, when increased in this way, as some other fruits.

Any further information regarding the geographical relation of the Hill plants, or their affinity in species or in habit, to those of other countries, would be interesting. Permanent residents there might favour us, occasionally, with an account of the productions, and, now that Ootacamund bids fair to be a permanent establishment, arboriculture might be introduced to more advantage than almost any other improvement.*†

* The names of species introduced into this paper will be found in the *Prodromus Floræ Peninsulæ*, by Dr. Wight, where the greater part of the Neilgherry plants are included.

† I have been reading, in the 5th Number of the Journal, the Review of Royle's Illustrations of the Himalayan Flora.|| It is very interesting, and I wish I had seen it before. I see the Reviewer places pines first on the list, in his recommendation of trees for the Neilgherries. I am very glad to have such authority for this suggestion. It is odd that Government has not directed its attention at all to the planting of trees on the hills. Those of the plain of course do not grow, and those already there are thought nothing of, and are never planted in any situation. I see the Reviewer of the illustrations notices the similarity of plants growing at Courtallum to those of the Eastern islands, which so far accords with my idea.—*Letter of the Author to the Editor.*

|| From the able pen of Dr. Wight.—*Editor.*

VI.—*A brief notice of some of the Persian Poets, by* T. J. NEWBOLD, *Lieutenant*; A. D. C. *to Brigadier General* WILSON, C. B.

(Continued from Vol. III. page 47.)

Firdousi,

فردوسی

Or *Abu'l Cassim Hussan Bin Ali Al Toosi* (*a*)—the most celebrated historical poet of whom Persia has to boast. He was the son of *Tshak Sherif Shah*, the gardener of *Súri Bin Moezz*, of the city of *Toos*, or *Meshed*, in *Khorasan* (hence the appellation of *Toosi)*, and was born, in the 4th century of the *Hejira*, on an estate of Súri's called *Firdous :* from this circumstance he obtained the title of *Firdousi*, the heavenly, by which he is generally known. Some authors assign the honour of his birth place to a small town, called *Rizan*, near the city of *Samarcand* in *Transoxania* ; but they do not appear to have had any good authority for having done so. He repaired, at an early age, to *Gházneh* to apply to Sultan *Mahmúd*, son of *Sebekhtagin*, first monarch of the dynasty of the *Gháznavides*, for redress against the governor of *Toos*, from whom he had experienced some act of oppression; and, probably, urged by a wish to escape from, and shake off, the trammels, his lowly duties as a labourer imposed on the aspirations of a soul, already beaming with poetic fire.

Firdousi soon distinguished himself, by his genius, among the crowd of poetical competitors by whom the (*b*) court of this distinguished conqueror, and patron of literature, was adorned, and was selected by *Mahmúd* to embody in verse the ancient chronicles of the Persian empire, extending, from the time of the antediluvian dynasty of *Kaiúmers*, down to the end of that of the *Sassánian* race, the fourth dynasty of the Persians, which commenced with *Ardashir Babegán*, or *Artaxerxes* (not *Longimanus*), and terminated with *Yezdegerd Parviz*. (*c*) The illustrious poet (*d*) *Anseri* had been solicited by the

(*a*) Firdousi has been also styled, Bin-Sherif, Sherifshah, Al Mansúr and *Danishmend-i-Ajem.*

(*b*) Among the numerous men of learning, that attended Mahmúd's court, Ferishta enumerates the poets, Azuri Razi ; Assedi Toosi, the master of Firdousi ; Munnu-Chíhr, a noble of Balkh, famous both for poetry and wit ; the philosopher and poet Anseri, whom four hundred poets and learned men, besides the students of the university of Ghiznij acknowledged for their master ; Asjedi of Murv, a scholar of Anseri, Furrokhi and Dakíki. *Vide Briggs's Ferishta, vol.* I. *page* 90—1 and 2.

(*c*) According to Persian historians, four dynasties reigned in Persia previous to its conquest by the Arabs in 15 A. H. 1. That of the *Kaiúmers* or *Peshdádians*, founded by *Kaiúmeras* a monarch supposed to have been cotemporary with *Enoch.* 2. That of the *Kaiánians*, founded by *Kaicobad*, who is supposed to have reigned about 600 years before Christ. 3. That of the *Ashkanians*, founded by *Ashek*, who is said to have been the son of *Dára*, and grandson of *Dárab*, or *Darius Codomanus :* this dynasty is said to have

Sultan to perform this task, but had repeatedly excused himself on plea of his age, his numerous avocations as a minister of state, &c. and finally declined in favour of his juvenile competitor, the subject of this sketch, whom he most disinterestedly recommended to *Mahmúd*, as the only person competent to this great undertaking.

Firdousi was accordingly introduced to the Sultan, who reproved him for not having presented himself before, and desired the young aspirant to produce a specimen of his skill. *Firdousi* immediately improvised several couplets, from which the following are extracted :—

كنون شاه دارد بگفتار گوش   تو فردوسي از قوت دل بكوش
سخن ماند از ما همين يادگار   سخن را چنين خوار پايه مدار
سخن بهتر از گوهر شاهوار   چو بر جا يگاهش بري بر نگار
برآرم من اين نامهٔ باستان   بگيتي بماند بمن داستان
بنام جهاندار محمود شاه   ابو القاسم آن فر ديهيم و گاه
به بزم و به رزم و به بخشش و شكار   زمانه نه بيند چو تو شهريار
خداوند هند و خداوند چين   خداوند ايران و توران زمين
بدرّد در آواز و گوش سنگ   بدريا نهنگ و بخشكي پلنگ
نجويد بجز خوبي و راستي   ندارد بداد اندرون كاستي
چو كودك لب از شير مادر بشست   بگهواره محمود گويد نخست
بايران همه خوبي از داد اوست   جهان شادمان از دل شاد اوست
به بزم اندرون آسمان وفاست   برزم اندرون تيز دم اژدهاست
بتن زنده پيل و بجان جبرائيل   بكف ابر بهمن بدل رود نيل

reigned about 315 years. 4. That of the *Sassanians*, which commenced with *Ardashir Babegán* (son of *Sassan*, a herdsman, but of the royal blood of the *Kaianians*), who is supposed to have flourished in the 3d century of the Christian era, and which terminated with *Yezdegerd Parviz*, about 651 A. D.

(d) " Anseri was appointed by the Sultan to superintend literature ; and no work could be brought before Mahmúd, without being previously submitted for his approbation." *Briggs's Ferishta, vol.* I. *page* 91.

For a short account of Anseri, and of his reception of Firdousi, on his first arrival, vide No. 8 of this Journal—*page* 250.

TRANSLATION.

Let the king now lend ear to my discourse,
And do thou, O *Firdousi*, take courage and exert thyself,
For what thou sayest will remain, in lasting remembrance of thee.
Therefore, commence; not on a mean foundation,
But depict sublime conceptions, in language better than kingly jewels,
And beseeming *Mahmúd's* dignity.
I will compose a poem of past ages,
That shall remain a lasting history in the world.
Dedicated to the possessor of the earth, *Mahmúd Shah,*
Abúl Cassim Anfer, Dehim wa Gah. (literally crown and throne)
In the banquet, the battle, generosity and field sports,
Thy equal, O king, the world will never behold.
Lord of *Ind*, Lord of *Chin* (China),
Lord of the lands of *Irán* and *Tuhrán*;
The sound of thy voice rends stones;
On the water thou art a crocodile, on dry land a tiger;
Thou seekest nothing save goodness and virtue,
And art indefatigable in administering justice.
As soon as the infant's lips are bathed with its mother's milk,
From the cradle it first murmurs the name of *Mahmúd*.
All *Irán* owes its prosperity to his justice,
The universe rejoices when he is glad;
In the banquet he is a heaven of benevolence,
In the combat a fiery dragon;
In person an elephant; in courage, *Jibráil.*
His hand graspeth the cloud of *Bahman,* (*a*)
His heart overfloweth with kindness like the river Nile.

The monarch was quite satisfied—apartments in the royal palace, and a handsome salary, were immediately assigned to our young poet, who commenced his task with great ardour. According to the author of the *Sham-i-Guriban*, a thousand couplets were produced, in a very short space of time, and presented to *Mahmúd* for his opinion. The monarch was so charmed with the richness and vigour of style, in which they were composed, that he ordered a thousand *dinars* (*b*) of gold to be instantly presented to the author. The rest of the poem, in all

(*a*) *Bahman*, according to Richardson, is the name of the second month of winter, answering to our January. The rain, that falls from the clouds during this month, was supposed by the Persians to have extraordinary fertilizing powers—hence the metaphor in allusion to Mahmúd's munificence.

(*b*) The term *dínar* is sometimes applied to money generally. A *dínar* of gold, according to Richardson, is of equal value with a ducat: according to D'Herbelot, it is worth a little more than the old *écu d'or*, and is equivalent to a sequin of Venice, and weighs one *miscal*.

upwards of 60,000 distiches, was completed after thirty years indefatigable labour.

While *Firdousi* was thus engaged, many insidious attempts were made by his enemies, to ruin him in his sovereign's estimation, by asserting that his religious opinions were not orthodox, and, in fact, that he was at heart a *Shia* or *Rafizi (a)*; grounding their allegations on some lines, in the commencement of the *Shah-nameh*. *Mahmúd*, who was a bigoted *Súnni*, became infuriated, and, sending for *Firdousi*, ordered him to be trampled to death by elephants; but, softened by his earnest protestations of innocence, and by the intercession of his generous friend *Anseri*, was eventually induced to pardon him, on condition that he should, thenceforward, carefully eschew all heterodox opinions.

When the *Shah-nameh* was completed, *Firdousi* presented it to the Sultan, in the full hope of receiving, as before, a *dinar* of gold for each couplet, or of obtaining some equivalent, in an appointment at court. But these expectations were doomed to be fatally disappointed. Some envious persons, among the rest *Ayaz* (a courtier who had on a former occasion attempted to ruin *Firdousi*), and *Abu Sahil Hamadáni*, by their insinuations that his former heretical tenets still remained unchanged, persuaded *Mahmúd* that sixty thousand *(b) dirhams* of silver would be ample recompence for a *Rafizi.* The Sultan, yielding a ready ear to their poisonous calumnies, instead of sixty thousand *dinars* of gold sent sixty thousand *dirhams* of silver only. *Firdousi*, in disdain, took the money, distributed a third in charity, and bestowed the remainder on a *Fakài* (a vender of *fáka*, a fermented liquor resembling beer), and on the attendant of his bagnio, where he happened to be, at the time when the Sultan's messenger arrived. This done, according to *Doulet Shah*, he hid himself for some days in *Gházneh*, and surreptitiously obtained possession of the copy of his poem from the royal archives, and inserted therein a spirited and bitter satire against *Mahmúd.* Others say

(a) Mohammedans are divided into two great sects—the Sunnites and the Shiites, or partizans of Ali (these are again numerously sub-divided). " The chief points wherein they differ are, 1. That the Shiites reject Abu Beer, Omar and Othmân, the three first Khalîfs, as usurpers and intruders; whereas the Sunnites acknowledge and respect them as rightful Imâms. 2. The Shiites prefer Ali to Mohammed, or, at least, esteem them both equal; but the Sunnites admit neither Ali, nor any of the prophets to be equal to Mohammed. 3. The Sunnites charge the Shiites with corrupting the Koran, and neglecting its precepts; and the Shiites retort the same charge on the Sunnites. 4. The Sunnites receive the Sunna, or book of traditions of their prophet, as of canonical authority; whereas the Shiites reject it as apocryphal, and unworthy of credit. And to these disputes, and some others of less moment, is principally owing the antipathy which has long reigned between the Turks, who are Sunnites, and the Persians, who are of the sect of Ali."—*Sale's preliminary discourse*, *Sec.* 8, *p.* 237.

(b) A *dirham*, according to Shakspeare, is a silver coin, of which from 20 to 25 have at different times passed current for a *dinar*, which is nearly equal to a ducat, or sequin, about 9 shillings.

that he merely wrote it on a scrap of paper, which he sealed up and gave to *Ayaz*, whom he had long, with reason, suspected of being his chief traducer; assuring him that it contained a pleasant story, and desired him to give it to *Mahmúd*, at a time when any business of importance, or bad success, should irritate his temper. However, after the completion of the satire he fled from *Ghâzneh* by night, on foot, and passed into *Zolustan*, where he was received with marked hospitality by *Mesr Mulk Mótasham*, governor of the province. Of this nobleman *Firdousi* solicited, with much earnestness, permission to inscribe the *Shah-nameh* to him, as the exploits of his ancestors were therein celebrated: the governor, however, fearful of *Mahmúds* resentment, would not accede to his request, saying that he was but a vassal of *Mahmúd's*, and offered *Firdousi* a handsome present, provided he would not publish the satire. This, it is said, the irritated poet at last consented to. But the Persian proverb declareth, " speech is a bird, and a bird whose pinions are not to be broken"—the satire got wind, and for point and bitterness has been, rarely, if ever, excelled, by the composition of any other Persian writer. In an article, contained in the Asiatic Journal for November 1829, purporting to be taken from an extended analysis, by M. de Sacy, of the *Tuzkirat-us-Shoara* of *Doulet Shah al Samarcandi*, is the following translation of this satire so celebrated among oriental writers :—

" But what virtues can be expected from Mahmoud, whose soul is barred against generosity,
What can be hoped for from a king without judgment, morality, or religion ?
The son of a slave, *(a)* though adorned with a diadem, eventually reveals the baseness of his origin.
Plant, even in the garden of paradise, a tree whose fruit is bitter,
Water it with the streams from the fountain of Eternity, and bedew its roots with honey,
Its natural qualities will always appear, and bitter, after all this care, will still be its fruit.
Place beneath the heavenly peacock the egg of a raven formed in infernal darkness,
When it is hatched, feed the young one with fig-seeds from the fig tree of Eden,
Cause it to drink of the water of Salsebil, and let the angel Gabriel breathe upon it ;
All this will not avail : a raven's egg will produce nothing but a raven.
Put a young viper upon a bed of roses, and nourish it with drops from the fountain of life ;
It will, notwithstanding, never become tame, and will infect you with its venom.
Transport an owl from the forest to the charming retreats in your garden, let it perch, during the night, upon rose-trees and sport amongst hyacinths ;
When the day expands its radiant wings, the owl will stretch out its own pinions to return to its native forest.
Consider these words of our prophet : every thing returns to its source.
Pass the shop of a perfumer, and your habit will imbibe the scent of ambergris.
Approach the forge of a blacksmith, and the smoke of the fire will soil your dress.
Be not surprised, then, at the evil deeds of a wicked man : can night change her hue ?
Look not for liberality from a base mind : can the face of an Ethiop become white ?
Far better it is to cast dust into your own eyes than to praise an avaricious prince.
O king, if thou hadst been noble and generous, and hadst walked in the path of virtue,
Thou hadst not thus overturned my hopes, but regarded me with a different aspect."

(a) Mahmud was the son of Sebekhtagin, a Turkish slave, the property of Alpteghin governor of Ghazneh.

Sir William Jones has also translated part of it, in French, in his *Traité sur la poesie Orientale.*

Firdousi, not feeling himself secure, made but a short sojourn with *Mésr Mulk Mòtasham*, and afterwards turned his steps towards *Mazenderan;* but, not finding an asylum there, fled to *Bagdad*, where he was hospitably received by *Caliph Kadir Abbási.*

About this time, *Mahmúd* was in the midst of his victorious career in the plains of *Hindustan*, but, on returning to *Gházneh*, was again instigated, by the unfortunate poet's enemies, to demand from the *Caliph* the immediate seizure of *Firdousi*, and transmission as a prisoner to *Gházneh* (*a*). The *Caliph*, respecting the aged poet's years (for he had already numbered seventy), but not daring to disobey altogether the tyrant's peremptory mandate, dismissed him the court, with an abundant supply of money: *Firdousi*, almost broken-hearted, proceeded to his native place *Toos.*

According to *Ferishta*, some time after this flight to *Toos*, *Firdousi* was lamenting his age and infirmities to his old preceptor *Assedi*, saying, that he should thereby be prevented from bringing his great work to an accomplishment; and expressed his conviction, that no other poet would be willing to engage in the labour after his death (of which approaching event it would appear that he had even then fatal forebodings). *Assedi* rejoined, that he, too, was far advanced in years, and quite unequal to so arduous an undertaking. On this they separated: but *Assedi*, when alone, took up his pen; and, in an incredibly short space of time, wrote down the four thousand concluding couplets of the *Shah-námeh*, commencing with the conquest of Persia by the Arabs under the *Caliph Omar* (*b*). It is stated, that, about this time, *Mahmúd*, having despatched a message to the Emperor of *Delhi*, and being extremely anxious to ascertain what would be the result, ordered his vizier *Maimendi*, to try the *sortes Firdousianæ* when the following distich turned up:

(*a*) D'Herbelot, quoting the author of the *Nuwâdir*, gives the following account of what passed between the Caliph and Sultan *Mahmûd.*

" Cader qui étoit homme fort sage, et moderé, ne répondit autre chose aux menaces du Sultan qu'en lui écrivant les paroles d'un chapitre de l'Alcoran intitulé *l'Elephant*, où il est parlé de la défaite miraculeuse de l' armée d'Abrahah Roy d' Ethiopie qui entra dans l'Arabie avec de puissantes troupes, et un grand nombre d' Elephans pour ruiner la ville et le Temple de la Mecque. Les paroles du verset qu' il lui envoya, sont : *Ne sçavez vous pas comment Dieu a traité les gens de l' Elephant?* Cader se servit fort à propos de ce passage, parce que le Sultan Mahmûd qui étoit Roy des Indes, avoit un tres grand nombre d'Elephant dans son armée, et qu'il n'y avoit que la puissance de Dieu qui pût renverser d'aussi grandes forces que les siennes; lui qui avoit accablé à coups de pierre que des grües lançoient du ciel, les troupes d'Abrahah l'Ethiopien."—*Bibliotheque Orientale. Art. Cader.*

(*b*) Vide Dow's Hindustan, vol. I. p. 77.

بیت

اگرنه بکام من آید جواب

من وگرز ومیدان افراسیاب

If an answer contrary to my wish
Be received ; then Afrasiab, myself
And my battle-axe, must decide
The matter in the field of combat.

This well timed *sors*, so applicable to his position, induced *Mahmúd* to think on the unhappy poet's condition with compassion: and, in order to make some atonement for his former injustice, and to alleviate the difficulties attendant on his declining age, at last ordered the long expected 60,000 *dinars* of gold to be sent him; or, according to some, twelve camels laden with indigo, together with the royal permission to reside wherever he pleased. But alas! too late—the camels, laden with the gold, met the corpse of *Firdousi* at the city gate, as it was borne out by a train of weeping friends to its final resting place. Bowed down with sorrow, the aged poet fell dead from his seat in the market-place of the city, while hearing a youth recite to him some passages of his own great epic the *Shah-nameh*. The gold was taken back to *Mahmúd*, who ordered it to be given to *Firdousi's* only child, a daughter. The spirited maiden refused the glittering treasure with scorn, saying, that as the uultan had not thought fit to send it before, and as it could now be of no use to her deceased parent, she had returned it untouched. *Mahmúd*, it is said, expressed unbounded admiration at her conduct, and repenting having lent so ready an ear to the envious insinuations of his courtiers, deeply mourned the poet's unhappy fate. The priest of the mosque refused to inter the corpse with the usual ceremonies, under the pretext that poets, in their compositions, perpetuate, and give too much credit to, the idle fables of infidels. The night after this refusal had been made, he dreamt he saw *Firdousi* seated in the seventh heaven: on enquiring how he had contrived to attain this exalted felicity, *Firdousi* answered, "one couplet on the power and eternity of the Deity has secured it for me." It is almost needless to add, that the priest's religious scruples were entirely dissipated by this most special vision, and that the corpse of the poor poet met with due mussulman interment. The following is the distich alluded to :

بیت

جهان را بلندی و پستی توئی

همه نیستند هرچه هستی توئی

Thou art to the world height and profundity :

All is mortal ; thou alone, of all that has existence, art eternal.

The death of *Firdousi* took place A.H. 411, in the reign of *Caliph Kádir* the twenty-fifth *Caliph* of the house of the *Abbassides.*

The poem of the *Shah-námeh,* the splendid pedestal on which rests the monument of *Firdousi's* fame, comprizes upwards of 60,000 couplets, the first thousand of which, according to the author of the *Tarikh-i-Guzídeh,* and also *Ferishta,* were composed by the poet *Dakíki* (vide " *Dakíki,*" vol. III. p. 46. of this Journal), who was prematurely cut off by assassination, four thousand by *Assedi,* as has been previously stated, and the remainder by *Firdousi.*

In the *Shah-námeh* is found the history of the ancient sovereigns and great men of Persia, from *Kaiúmeras,* who is said to have reigned before the deluge, cotemporary with *Enoch,* and to have founded the dynasty of *Peshdadians,* from whom the first kings of *Babylonia, Assyria* and *Media,* are supposed to have their origin, down to *Yezjerd,* who was treacherously slain by some inhabitants of *Merov,* after his defeat by the Arabian conquerors of Persia, at the battle of *Kadessia,* in the 31st year of the *Hejira,* when the religion of the fire-worshippers, the institutions of the *Magi,* and the ancient laws of Persia were abolished, by those zealous promulgators of the tenets of Islam.

It was compiled from the ancient chronicles of Persia, which, it is most probable, were written in *Páhlevi,* although Mr. Richardson, in his dissertation on the languages, &c. of Eastern nations, gives the preference to the *Parsi* dialect, which he states to have been peculiarly cultivated by the great and learned, above 1,200 years before the Mohammedan era.

On the other hand it must be stated, that the opinions of several Persian authors, Sir William Jones, and many learned Mussulmans of India, with whom I have conversed on the subject, are in favour of the *Páhlevi.*

Firdousi prided himself on not having introduced one Arabic word in the composition. On a friend's denying this, and pointing out the line

مصرع

فلک گفت احسن ملک گفت زه

"The heavens exclaimed *Ahsan*, (most excellent)
"The prince cried, zih! (bravo)"

saying that *Ahsan* was an Arabic word. *Firdousi* admitted it, but observed, "It was not *I*, but *Heaven* that said it;" meaning that it would have been improper, to have put any other language than Arabic, into the mouth of any celestial personification: it being the language of divine revelation, *i. e.* according to the followers of Mahomed.

The *Shah-námeh* has been translated into Arabic prose by *Kaium-úddin Fateh Abu Ali Al Hindi Isfaháni*, who undertook the task by order of *Sultan Malek-al-azem Issa*, son of *Malek-al-adil* of the house of the *Aiúbites*. A. H. 675.

There is also a prose abridgment called the *Shah-námeh-nasr*, made for the learned Dr. Hyde by a Parsi of Surat, of which there is a copy in the British museum marked Hyde-Rayal. 16. B. XIV. Translated extracts from this work, comprizing the loves of *Khosru* and *Shírin*, the romance of *Kai Kous*, *Rustam's* seven adventures, &c. made by W. Ouseley, Esq. will be found in vol. I. and II. of the Oriental Collections.

Mr. Ouseley also mentions a prose and verse abridgement, which he calls, the *Montekheh Shemshir Khani*, or *Towarikh Shah-námeh Turvukkul Beg*. Of this work I once possessed a copy, purporting to have been abridged from the *Shah-námeh* by *Turvukkul Beg*, by order of *Shamshir Khán Hákim* of *Ghazneh*, under the auspices of *Dára Shekóh*, son of the emperor *Shah-Jehan*. It is also called *Khuláseh-i-Shah-námeh*.

There is another abridgment in use, with the native Persian *dilettanti* of India, by one *Ghulam Hussain* of *Bijapur*.

D'Herbelot, mentions four works under the title of *Shah-nameh*. The first "Livre Turc, comprenant une histoire de tous les anciens Rois de l'orient, en trois cens volumes, composé par *Ferdoussi Al Thaouil*, Poëte Turc." This composition was presented by the author to *Bajazet* the second, Sultan of the *Osmanides*. The second—"Autre livre Turc en vers, qui contient quatre mill *Beits*, composé par *Schohoudi*, qui mourut l'an 943 de l'hegire, et dédia son auvrage au *Sultan Selïm*, fils de *Bajazet*." The third—A history or panegyric on *Shah Ismael*, composed in Persian verse by *Cassim Gunabadi*, and the fourth, entitled *Al Kadim* "composé en langue Arabique, par *Ali Ben Mohammed, Ben Ahmed, Al Balkhi*, surnommé, *Al Schâer*, c. a. le Poëte.

Perfect copies of *Firdousi's Shah-nameh* in verse, are now very rare in India, and large prices are asked for them. The copy, mentioned by Mr. Ouseley in his catalogue of the Arabic, Persian and Turkish manuscripts belonging to the British museum, is described by him to be decorated with ninety one very beautiful miniature paintings, executed in the best style of Indian artists, of whom several have been employed,

as appeared by their names thus inscribed in the pictures ; عمل شمال *Amal-i-Shumál*, the work of Shumal ; عمل بهکوتي *Amal-i-Bhakúti* the work of Bhakuti, &c. From the number and excellence of the pictures, Mr. Ouseley judges the manuscript to have been highly valued. Among the different Asiatics, into whose possession it had fallen, and whose names and seals it bears, one had noticed that he paid for it the sum of seven hundred rupees (about £70) ; and another, in a more recent hand, remarked that it cost him 1,500 rupees (about £150).

It is stated that *Firdousi* produced several other poems. Among them is one on the loves of *Yussúf-wa-Zuleikha*, very rarely met with. His *Shah-námeh* may be truly called the Iliad of the Persians : we are told, that the poems of Homer were so universally admired by the Greeks, that every man, who had any pretensions to learning, could repeat, from memory, passages from the Iliad and Odyssey, and it was accounted a mark of gross ignorance not to be able to do this. Such is the case, we are informed by modern travellers (*a*), to the present day in Persia, as regards the *Shah-námeh* of *Firdousi* : and, moreover, the melancholy fate of this poet powerfully reminds us of that of the Grecian bard, who, when living, begged his bread, but, dead, seven cities contended for the honour of his birth-place.

> " Smyrna, Chio, Colophon, Salamis, Rhodos, Argos, Athenæ,
> Orbis de patriâ certat, Homere, tuâ."

Firdousi has been compared to *Nizámi* (a celebrated poet of whom notice will be taken hereafter), but excels him, as all other Persian poets, in fire, sublimity, sweetness and pathos, and in freedom from the superabundant metaphor, and that endless suite of tasteless similes, &c. so well known to Persian poets, of more modern date, under the title of " *Ibáret-i-rungin.* He has been censured by many, on account of the absurdity and incredibility of the supernatural creations, with which a great number of the episodes of his heroic are crowded. But, should they not pause to consider, that the earlier portions of even the best accredited chronicles of the various kingdoms of the world,

(*a*) Mr. Scott Waring, speaking of the Persians, observes that " It is the custom with them to converse upon literary subjects, and repeat a variety of verses before supper," and that the extent of their memory is really astonishing, being able to repeat almost any ode that happens to be mentioned. Further that " another amusement, among those who can afford it, is listening to a *Shah-namu-khoon*, a person who repeats and acts various passages of Firdousi's epic poem, called the Shah-namu. This is an amusement of a very superior kind, and one which a stranger is sure to delight in. They act the different descriptions of the poet with great spirit, particularly the account of the battle between Roostum, the hero of the poem, and Sohrab."

For further corroboration of this, vide Sir John Malcolm's Persia.

are necessarily clouded with the obscurity of ignorance, and peopled with the creations of tradition and dark superstition ?

Shall we reject and throw aside altogether the annals of Greece, Rome and Phenicia, because they contain the fables of the Titans, the centaurs, and the other mythological enormities, that figure in the writings of men like Hesiod, Diodorus, Pausanias, Apollodorus and *Sanconiathon?* Shall we eternally seal the books of *Herodotus*, for his having interwoven the valuable facts, that fell under his personal observation, with the artful fabrications communicated to him by the priests of *Vulcan* at *Memphis*, and by the officials of *Jupiter Belus* at *Babylon*? Besides this, it is to be held in remembrance, that poets, from the earliest times, have been a privileged race, and have continued to exercise the license of introducing, *ad libitum*, the machinery of aerial and other creations of the fancy into their compositions. Instance the gods and goddesses of *Homer*, *Hesiod* and *Virgil;* the *Deotas* and *Rachásas* of the *Mahabhárat* and *Ramayána;* the *Mambangs* and *Widadáris* of Malay and Javan poesy; the ghosts and spirits of *Ossian*, the Pantheon of Scandinavian mythology as depicted in the *Volúspa* of the *Edda;* together with the magic and enchantments of the Runic, and old British, romances. Turn we to more modern days—the hosts of angels, demons, fairies and sorcerers, that figure in Milton's Paradise lost; the *Inferno* of Dante; Spenser's Fairy Queen; the *Gierusalemme Liberata* of Tasso, and the *Orlando Furioso* of Ariosto, may not, perhaps, be unaptly compared with the legions of *Dives*, *Peris*, *Genii*, and other supernatural agents, which the Persian poet has invoked to his aid, from the fairy regions of fancy, or from the obscure and murky caverns of tradition. Finally, to use the words of the talented author of the " Sketches in Persia", " It is only justice to this great poet, to observe, that the exuberance of his fertile imagination, though it led him to amplify and adorn his subject, never made him false to the task he had undertaken, that of embodying, in his great work, all that remained of the fabulous and historical traditions and writings of his country. We cannot have a stronger proof of his adherence to this principle, than his passing over, almost in silence, the four centuries which elapsed between the death of *Alexander* the *Great*, and the rise of *Ardesheer*, or *Artaxerxes*, the founder of the *Sassanian* dynasty."

VII.—*An account of the Customs and Practices of the murderers called Thugs.—By* Lieut. P. A. Reynolds, *of the 38th Regiment Madras N. I.**

The *Thugs* form a numerous class of persons, who subsist, almost entirely, upon the plunder procured from the murders they are in the habit of committing. They appear to have derived their denomination from their practice of decoying the persons they fix upon to destroy, to join their company; and then, taking advantage of the confidence they endeavour to inspire, strangling their unsuspecting victims. They are also known by the name of *Phansigars;* and, in the north eastern part of the Nizam's dominions, are usually called *Kurkbunds.*†

There are several peculiarities in the habits of the *Thugs,* in their mode of causing death; and in the precautions they adopt for the prevention of discovery, which distinguish them from every other class of delinquents; and it may be considered a characteristic of them, that they affect to disdain the practice of petty theft, house-breaking, and,

* Although accounts have been before the public (one in the eighth number of this journal) concerning those *anomalies* of the human race who are the subject of this paper, yet the Editor is aware of none so copious in their nature, and, at the same time, so authentic in their source, as that now published. To a great number of the readers of this journal the subject will be altogether new, it is presumed; for we live in our *English homes,* and, even in India, have the refinements of European civilization about us, and little dream such deeds are committed so near our doors. And, though we have all heard how desperately wicked the human heart can be, yet it is likely that even imagination, in its wildest mood, never pictured to itself any thing half so dreadful as the tale of horrors here unfolded, in the description of the ordinary habits and practices of a widely spread class of mankind. Another value which Lieutenant Reynolds' account possesses, is, that it carries down the history of these atrocious villains to the present time, and affords society the consolatory assurance, that outraged justice has not been without its victims, but that retribution has fallen on the heads of many of these unparalleled offenders against the laws of God and man; and, further, that, owing to the energetic measures of government, this criminal association is likely soon to be exterminated.—Editor.

† The Phansigars, or stranglers, are thus designated from the Hindoostani word *Phansi* پھانسی a noose. In the more northern parts of India, these murderers are called *Thegs,* ٹھگ signifying deceivers: in the Tamul language, they are called *Ari Tulucar* உறித்துலுக்கா or mussulman noosers: in Canarese, *Tanti Calleru,* ತಂಟಿಕಳ್ಳರು implying thieves who use a wire or catgut noose: and in Telugu, *Warlu Wahndlu* or *Warlu Vaysh ay Wahndloo* వులూ వాండ్లు వులూ వేసె వాండ్లు meaning people who use the noose.

Dr. Sherwood's account of the Phansigars.
Asiatic Researches, vol. 13, p. 251.

indeed, every species of stealing, that has not been preceded by the perpetration of murder.

The *Thugs* adopt no other method of killing but strangulation; and the implement made use of, for this purpose, is a handkerchief, or any other convenient strip of cloth. The manner in which the deed is done will be described hereafter. They never attempt to rob a traveller, until they have, in the first instance, deprived him of life. After the commission of a murder they invariably bury the body immediately, if time and opportunity serve, or, otherwise, conceal it, and never abandon a corpse on the highway unless they happen to be disturbed.

To trace the origin of this practice would now be a matter of some difficulty, for, if the assertions of the *Thugs* themselves are entitled to any credit, it has been in vogue from time immemorial, and they pretend that its institution is coeval with the creation of the world. Like most other inhuman practices, the traditions regarding it are mixed up with tales of superstition; and the *Thugs* would wish to make it appear, that, in immolating the numberless victims that yearly fall by their hands, they are only obeying the injunctions of the deity of their worship, to whom they say they are offering an acceptable sacrifice.

The object of the worship is the goddess *Hulee* or *Bhowanee*, and there is a temple at Binderchul, near Mirzapoor, to which the Thugs usually send considerable offerings, and the establishments of priests at that shrine are entirely of their community. *Bhowanee*, it seems, once formed the determination of extirpating the human race, and sacrificed all but her own disciples. But she discovered to her astonishment, that, through the intervention of the Creating power, whenever human blood was shed, a fresh subject immediately started into existence to supply the vacancy. She therefore formed an image, into which she instilled the principle of life; and, calling together her disciples, instructed them in the art of depriving that being of life, by strangling it with a handkerchief.

This method was found on trial to be effectual, and the goddess directed her worshippers to adopt it, and to murder, without distinction, all who should fall into their hands, promising herself to dispose of the bodies of their victims, whose property she bestowed on her followers, and to be present to preside over and protect them on those occasions, so that none should be able to prevail against them.

Thus, say the *Thugs*, was our order established, and we originally took no care of the bodies of those who fell by our hands, but abandoned them wherever they were strangled, until one man, more curious than the rest, ventured to watch the body he had murdered, in expectation of seeing the manner in which it was

disposed of. The goddess of his worship, descended, as usual, to carry away the corpse, but, observing that this man was on the watch, she relinquished her purpose; and, calling him angrily, rebuked him for his temerity, telling him she could no longer perform her promise regarding the bodies of the murdered, which his associates must hereafter dispose of, in the best way they could. Hence, say they, arose the practice, invariably followed by the *Thugs*, of burying the dead; and to this circumstance, principally, is to be attributed the extraordinary manner in which their atrocities have remained unknown; for, with such circumspection and secrecy do they proceed to work, and such order and regularity is there in all their operations, that it is next to impossible a murder should ever be discovered.

Absurd as the foregoing relation may appear, it has had this effect on the minds of the *Thugs*, that they do not seem to be visited with any of those feelings of remorse or compunction, at the inhuman deeds in which they have participated, that are commonly supposed to be, at some period of their lives, the portion of all who have trafficked in human blood. On the contrary, they dwell, with satisfaction, on the recollection of their various and successful exploits, and refer, with no small degree of pride and exultation, to the instances in which they have been personally engaged, especially if the number of their victims has been great, or the plunder they have acquired has been extensive.

It is generally believed that *Thugs* are a distinct sect or race, but this is not exactly the case. The crime is hereditary in families, and many *Thugs* name their forefathers, as leaders of gangs, for twenty generations past. They recruit their numbers from all classes, and are themselves found in all sorts of guises. *Thugs* have been found as native officers and privates, in the regiments of the Company and native princes; they have been arrested, in the capacity of servants to European officers, residing in military cantonments; some have been established, as merchants and traders, in towns and military bazars, where they have obtained a character for honesty and plain dealing. Others have assumed the characters of religious mendicants, or attendants on sacred shrines, passing their time in reading the Koran, and only quitting home to visit some distant and holy place; and the chief informer, among those arrested, was a peon on the personal establishment of Sir David Ochterlony!

Notwithstanding their adherence to Hindoo rites of worship observable among the *Thugs*, a very considerable number of them are Mussulmans. No judgment of the birth, or caste, of a *Thug* can, however, be formed from his name, for it not unfrequently happens, that a Hindoo *Thug* has a Mussulman name, with a Hindoo alias attached to it; and, *vice versâ* with respect to *Thugs* who are by birth Mahomedans. In almost every instance, these people have more than one appellation, by

which they are known. Of the number of Mussulman *Thugs*, some are to be found of every sect, Shaikh, Sied, Mogul and Puttan ; and, among the Hindoos, the castes chiefly to be met with, are Brahmins, Rajpoots and Holees. In a gang of *Thugs*, some of every one of these castes may be found, all connected together by the peculiar plan of murder practised by them ; all subject to the same regulations, and all, both Hindoos and Mussulmans, joining in the worship of *Bhowanee*.

They usually move in large parties, often amounting to one hundred or two hundred persons, and resort to all manner of subterfuges, for the purpose of concealing their real profession. If they are travelling southward, they represent themselves to be either proceeding in quest of service, or on their way to rejoin the regiments they pretend to belong to in this part of the country. When, on the contrary, their route lies towards the north, they represent themselves to be sepoys from corps of the Bombay, or Nizam's, army, going, on leave, to Hindoostan.

The gangs do not always consist of persons who are *Thugs* by birth. It is customary for them to entice, by the promise of monthly pay, or the hopes of amassing money, that are held out, many persons who are ignorant of the deeds of death, that are to be perpetrated for the attainment of these objects, until made aware of the reality by seeing the victims of their cupidity fall under the hands of the strangler. The *Thugs* declare that novices have, occasionally, been so horrified at the sight, as to have effected their immediate escape ; others, more callous to the commission of crime, are not deterred from the pursuit of wealth by the frightful means adopted to obtain it, and, remaining with the gang, too soon begin personally to assist in the perpetration of murder.

Many of the most notorious *Thugs*, are the adopted children of others of the same class. They make it a rule, when a murder is committed, never to spare the life of any one, either male or female, who is old enough to remember and relate the particulars of the deed. But, in the event of their meeting with children, of such a tender age, as to make it impossible they should be able to reveal the fact, they generally spare their lives, and, adopting them, bring them up to the trade of *Thugee*. These men, of course, eventually become acquainted with the fact of the murder of their fathers and mothers, by the very persons with whom they have dwelt since their childhood, but are still not deterred from following the same dreadful trade.

It might be supposed that a class of persons, whose hearts must be effectually hardened against all the better feelings of humanity, would encounter few scruples of conscience in the commission of the horrid deeds whereby they subsist ; but, in point of fact, they are as much the

slaves of superstition, and as much directed by the observance of omens, in the commission of murder, as the most inoffensive of the natives of India are, in the ordinary affairs of their lives.

The chief symbol of worship among the *Thugs*, is a *Khodalee*, or pick-axe of iron. It is known among them by the names of *Nishan, Kussee* and *Mahee.* With every gang there is carried a *Nishan*, which is in fact their standard, and the bearer of it is entitled to particular privileges. Previous to commencing an expedition, the *Jemadars* of the party celebrate a *Poojah* to the *Nishan*, which is typical of the deity of the worship. The ceremonies differ little from the usual rites of Hindoos on similar occasions. A Hindoo *Thug*, of good caste, is employed in making a quantity of the cakes called *Poories*, which, being consecrated, are distributed among the assembly. The *Nishan* is bathed, and perfumed in the smoke of burning benjamin, and is afterwards made over to the *Nishan Wallah*, who recieves it in a piece of cloth kept for that purpose. It is then taken out into the open fields, in the expectation of an omen being observed. The *Nishan* is deposited in a convenient spot, in the direction the party intends to proceed, and certain persons are deputed to keep watch over it. There are particular birds and beasts, that are looked upon by the *Thugs* as the revealers of omens, to whose calls and movements their attention is, on this occasion, particularly directed. Among the number are the owl, the jay, the jackall, the ass, &c. &c. If one of these calls out, or moves to the right hand side, the omen is looked upon as favourable; but if to the left, it is considered unfavourable, and the project is abandoned. It is not unusual for the *Thugs* to look for a favourable omen, previous to the commission of a murder, and they are frequently deterred from carrying their intentions immediately into effect, by the observance of an unfavourable sign, such as a snake crossing their path when in pursuit of a victim, or the circumstance of any of the animals, before mentioned, calling out on the left hand side. This, no doubt, accounts for the *Thugs* so often keeping company with travellers, for many days previous to murdering them, although they had determined upon their sacrifice, from the moment of their first joining the party. The omen is denominated *Sugoo*, by the *Thugs*, a corruption no doubt of the Persian *Shugoor*.

In the event of an expedition proving more than ordinarily successful, a *Poojah* is usually made to *Bhowanee*, and a portion of the spoil, taken by the gang, is set aside, for the purpose of being sent to the the Pagoda before alluded to, as an offering to the goddess. Propitiatory offerings are also made, and various ceremonies performed, before the *Khodalee* or *Nishan*, should the *Thugs* have failed in obtaining any plunder for a length of time.

In every gang of *Thugs* there are to be found one or more *Jemadars* who appear to hold that rank, not by the choice of their followers, but,

in consequence of their wealth and influence in their respective villages, and having assembled their immediate followers in the vicinity of their homes. The profits of a *Jemadar* are, of course, greater than those of his followers. He recieves 6½ or 7 per cent on all silver coin, and other property not hereafter specified, and then shares in the remainder in common with the other *Thugs* of the party. When gold is obtained in coin, or in mass, the tenth part is taken by the *Jemadar*, previous to dividing it, and he has a tythe of all pearls, shawls, gold embroidered cloth, brass and copper pots, horses, &c. The *Jemadar* acts as master of the ceremonies when the *Poojah* is performed, and he assigns to every *Thug* the particular duty he is to undertake, in the commission of every murder that is determined on.

These duties are performed, in succession, by all the *Thugs* of the party, and to the regularity and system that exists among them, is to be attributed the unparalleled success that has attended their proceedings.

Next to the *Jemadar*, the most important person is the *Buttoat*, or strangler, who carries the handkerchief with which the *Thugs* usually murder their victims. This implement is merely a piece of fine strong cotton cloth, about a yard long. At one end a knot is made, and the cloth is slightly twisted, and kept ready for use in front of the waistband of the person carrying it. There is no doubt but that all *Thugs* are expert in the use of the handkerchief, which is called *Roomall* or *Paloo*, but, if they are to be believed, only particular persons are called upon or permitted to perform this office, when a large gang is collected. The most able bodied and alert of their number are fixed upon as *Buttoats*, and they are made the bearers of the handkerchiefs, only after the performance of various, and often expensive, ceremonies, and only on the observance of a favourable omen. The old and experienced *Thugs* are denominated *Gooroo Bhow*, and the junior *Thugs* make a merit of attending upon them, filling their hookahs, shampooing their bodies, and performing the most menial offices. They gradually become initiated into all the mysteries of the art, and, if they prove to be powerful men, these disciples of the *Gooroo* are made *Buttoats*.

The *Thugs* say that if one of their class was alone, and had never strangled a person, he would not presume to make use of the handkerchief, until he observed a favourable omen. The ceremonies are the same as those described in carrying out the *Nishan*, in room of which the handkerchief is, on this occasion, substituted, and an offering of pice, cocoanut, turmeric, red ochre, &c. is made. When a murder is to be committed, the *Buttoat* usually follows the particular person, whom he has been nominated by the *Jemadar* to strangle, and, on the pre-concerted signal being given, the handkerchief is seized, with the knot in the left hand, the right hand being some inches

further up; in which manner it is thrown over the head of the person to be strangled from behind. The two hands are crossed as the victim falls; and, such is the certainty with which the act is done, as the *Thugs* frequently declare, before the body reaches the ground, the eyes usually start out of the head, and life becomes extinct. Should the person to be strangled prove a powerful man, or the *Buttoat* inexpert, another *Thug* lays hold of the end of the handkerchief. The perfection of the art is described to be, when several persons are simultaneously murdered, without any of them having time to utter a sound, or to be aware of the fate of their companions.

Favourable opportunities are given to the *Buttoats*, to make their first essay in the art of strangulation. When a single traveller is met with, a novice is instructed to make a trial of his skill. The party sets off during the night, and stops, while it is still dark, to drink water or to smoke. While seated for this purpose the *Jemadar* enquires what time of night it may be, and the *Thugs* immediately look up at the stars to ascertain. This being the pre-concerted signal, the *Buttoat* is immediately on the alert, and the unsuspecting traveller, on looking up at the heavens, in common with the rest of the party, offers his neck to the ready handkerchief, and becomes an easy prey to his murderer. The *Buttoat* receives eight annas extra for every murder that is committed, and, if the plunder is great, some article of value is assigned to him, over and above his share. The persons intended to be murdered are called by different names, according to their sect, profession, wealth, &c. &c. A victim having much property is entitled *Mamud*, and they are also called generally *Rasy*.

To aid the *Buttoat* in the perpetration of a murder, another *Thug* is specially appointed, under the denomination of *Sumsooah*. His business is to seize the person to be strangled by the wrists, if he be on foot, and by one of his legs, if he be on horseback, and so to pull him down. A *Sumsooah* is told off to each traveller, and he places himself in a convenient situation near him, to be ready when required. In the event of the traveller being mounted on horseback, a third *Thug* assists, under the designation of *Bhug duria*. His business is to lay hold of the horse's bridle, and check it, as soon as the signal for murder is given.

One of the most necessary persons in a gang of *Thugs*, is he who goes by the name of *Tilláee*. The *Thugs* do not always depend upon chance for obtaining plunder, or roam about in the expectation of meeting travellers, but frequently take up their quarters in, or near, a large town, on some great thoroughfare, from whence they make expeditions, according to the information obtained by the *Tilláees*. These men are chosen from among the most smooth spoken and intelligent of their number, and their chief duty is to gain information. For this purpose they are decked out in the garb of respectable per-

sons, whose appearance they must have the tact of putting on. They parade the bazars of the town, near which their associates are encamped, and endeavour to pick up intelligence of the intended dispatch, or expected arrival, of goods, of which intimation is forthwith given to the gang, who send out a party to intercept them. Enquiry is also made for any party of travellers, who may have arrived, and put up in the Chowrie, or elsewhere. Every art is brought into practice to scrape an acquaintance with these people. They are given to understand that the *Tillaee* is travelling the same road. An opportunity is taken to throw out hints regarding the unsafeness of the road, and the frequency of murders, and robberies. An acquaintance with some of the friends or relatives of the travellers is feigned, and an invitation given to partake of the repast, that has been prepared at the place where the *Tillaee* puts up, the conveniences of which, and the superiority of the water, are abundantly praised. The result is, that the travellers are inveigled into joining the party of *Thugs*, and they are feasted and treated with every politeness and consideration, by the very wretches who are also plotting their murder, and calculating the share they shall acquire in the division of their property.

What must be the feelings of men, who are actuated by motives so entirely opposed to their pretended civility of behaviour, it must be difficult to imagine, and I know not whether most to wonder at the duplicity with which they contrive to conceal their murderous intentions, or to detest the infernal apathy with which they can eat out of the same dish, and drink of the very cup, that is partaken of by the victims they have fixed upon to destroy.

It is on the perfection which they have attained in the art of acting as *Tillaees*, that the *Thugs* particularly pride themselves, and it is frequently boasted of by them, that only one opportunity of conversing with a traveller is necessary, to enable them to mark him as an easy victim, whenever they choose to murder him.

Instances sometimes occur, where a party of T*hugs* find their victims too numerous for them to master, while they remain in a body, and they are seldom at a loss for expedients to create dissensions, and a consequent division among them. If all their arts of intrigue and cajolery, fail in producing the desired result, an occasion is taken advantage of to ply the traveller with intoxicating liquors, a quarrel is got up, and from words they proceed to blows, which end in the dispersion of the company, who, proceeding in different roads, fall an easy prey to their remorseless destroyers.

Having enticed the travellers into the snare they have laid for them, the next object of the *Thugs* is to choose a convenient spot whereon to murder them. This, in the technical language in use among them, is denominated a *Bhil*, and it is usual to fix upon a place a short distance

from a village, on the banks of a nullah, where the trees and underwood afford a shelter from the view of occasional passengers. The *Thug* who is sent on this duty is called a *Bhilla,* and, having fixed on the place, he either returns to the encampment of his party or meets them on the way to report the result of his enquiry. If the *Bhilla* returns to the camp with his report, the *Suggaees,* or grave diggers, are sent out with him, to prepare a grave for the interment of the persons it is intended to murder. Arrangements are previously made, so that the party, in company with the travellers, shall not arrive too soon at the *Bhil.* At the particular spot agreed upon, the *Bhilla* meets the party, a recognition takes place, the *Jemadar* calls out *Bhilla Manjeh* (have you cleared out the hole ?). The Bhilla replies, *Manjeh;* on which the concerted signal is given, that serves as the death-warrant of the unheeding travellers, who are forthwith strangled. While some are employed in rifling the bodies, others assist in carrying them away to the ready prepared graves. The *Suggaees* perform the office of burying them, and the remainder of the gang proceeds on its journey, leaving with them a certain number of the *Tillaees,* or watchmen, on the look-out to prevent their being disturbed; should a casual passenger appear, the *Tillaee* gently throws a stone among the *Suggaees,* or grave-diggers, who immediately desist, and crouch on the ground until the danger is averted. After the interment is completed, the *Suggaees* rejoin their party; but it is not unusual to leave one or more of the *Tillaees* to keep watch, to prevent the bodies being dug up by beasts of prey; and, if a discovery should be made by the village people, to give instant information to their companions, in order that they may have the opportunity of getting out of the way.

It often happens, that the arrangements and precautions abovementioned, cannot be entered into; that travellers are casually met with on the road, and hastily murdered, and as carelessly interred. In these cases, if the opportunity is afforded them, the *Thugs* always leave some one to keep watch at the place, and, rather than run the risk of detection, by the bodies being dug up by wild beasts, they return and re-inter them. If the ground is strong, they never touch the corpse; but if the soil is of so loose a texture, as to render it probable that the bodies, on swelling, will burst the graves, they generally transfix them with spears, or knives, which effectually prevents that result.

When the *Thugs* may choose to strangle their victims in some more exposed situation, as in a garden near a village, where they may have put up for the night, they adopt further precautions to prevent discovery. The grave is, on such occasions, prepared on the spot, after the murder has been committed, and, the corpse having been deposited therein, the superfluous soil is carried away in bundles, and strewn in the neighbouring fields. The place is watered, and beaten down with sticks; it is ultimately plaistered over with cow dung, and *Choolahs,* or

fire-places for cooking, are made on the spot. If the party find it necessary to decamp, they light fire in the *Choolahs*, that they may have the appearance of having been used to cook in; should they determine on staying, they use the *Choolahs* to cook their food in on the succeeding day, having few qualms of conscience to prevent their enjoying the victuals, prepared on a spot, the associations attendant on which might be considered too revolting to dwell upon. The parties of *Thugs* being often very large, they have many beasts of burden in their train, as bullocks, tattoos, and sometimes even camels. If they remain at a place, where they have committed a murder, and do not construct fire-places, they take the precaution of tying their cattle on the spot. The *Thugs* say they can always recognize the fire-places of their own class, there being peculiar marks about them, which are made to serve as directions to the next party that passes that way.

The *Thugs* always prefer burying their victims at some distance from the public road; and, therefore, as soon as the bodies of murdered persons have been stripped of the property found upon them, they are carried, on the shoulders of the *Suggaees*, to the spot selected for interring them. They say they are more careless about the concealment of corpses in the Nizam's country, than elsewhere, for they have always been so secure from molestation, that they have frequently left bodies exposed, without running any risk, for no one takes the trouble of enquiring about the matter.

The division of spoil does not usually take place immediately after the perpetration of a murder, but every person secures a portion of the property on the spot, and, when a convenient opportunity occurs, each produces the articles he has been the bearer of, and a division is made by the *Jemadars*, whose share is, in the first instance, deducted. Then the *Buttoats*, the *Sumsooahs* and *Bhug Duriahs*, claim the extra reward for each murder they have assisted at. The *Suggaee* takes his reward for the trouble he had in digging the grave, and the residue is divided, share and share alike, among the whole gang. It may be supposed that the cupidity of individual *Thugs* may, occasionally, induce them to attempt to defraud their comrades, by secreting any articles of value, at the time the murdered bodies are plundered. But, they say, that the whole class are bound by an inviolable oath, to produce, for appropriation to the common stock, every thing that may fall into their hands, while engaged with a particular party. The division of plunder, as may be supposed, often leads to the most violent disputes, which it is astonishing do not end in bloodshed. But, it might almost be supposed the *Thugs* have a prejudice against spilling blood, for, if pursued, they refrain from making use of the weapons they usually bear, even in defence of their own persons.

The most wanton prodigality occurs when plunder is divided, and

occasionally the most valuable shawls and brocades are torn into small strips, and distributed among the gang, should any difference of opinion arise as to their appropriation. The *Thugs* say this is also done, that every person may run the same risk; for such an article could not be shared among them, until converted into money, and some danger is attendant upon the transaction. They appear invariably to destroy all *Hoondees* that fall into their hands, as well as many other articles, that are likely to lead to detection. Ready money is what they chiefly look for, and, when they have a chance of victims, the possessors of gold and silver would certainly be fixed upon, in preference to others. In consequence, it seems to have been a general practice, among the Bundlecund *Thugs*, to waylay the parties of sepoys of the Bombay and Nizam's armies, while going on leave to Hindustan, for the sake of the specie they are usually the bearers of; and they remark that, of the many sepoys who are supposed by their officers to have abandoned the service, while their friends and relatives consider them to be still with their regiments, they alone can tell their fate, the whole number having been strangled by their hands.

The immense wealth that has, at various times, fallen into the hands of these miscreants, has been expended in the grossest extravagance and debauchery, and, as may be supposed, their ill-gotten gains remain but a short time in their possession.

The *Thugs* have in use among them, not exactly a language of their own, but sets of slang terms and phrases, which give them the means of holding a conversation with persons of their own class, without any chance of being understood by the uninitiated.

Their term of salutation, whereby also they recognize each other, if they casually meet, without being personally acquainted, is *Ali Khan Bhaee Salam*. That which appears most extraordinary, is the manner in which the *Thugs* recollect the names of their comrades, as well as their persons, and they declare that, though the name of any one of a gang may have escaped their recollection, they never forget the person of a *Thug* who has assisted with them in the perpetration of a murder. The *Thugs*, indeed, seem to know each other almost instinctively, and the quickness, with which the recognition between individuals takes place, is so surprising, as to indicate a sort of free-masonry having been established among them.

To facilitate their plan of operations, the *Thugs* have established a regular system of intelligence and communication, throughout the countries they have been in the practice of frequenting; and they become acquainted, with astonishing celerity, with the proceedings of their comrades in all directions. They omit no opportunity of making inquiries regarding the progress of other gangs, and are equally particular in supplying the requisite information of their own movements,

For this purpose they have connected themselves with several persons residing in the Nizam's dominions, as Potails, and cultivators, of villages; many of the latter of whom follow the profession of *Thuggee*, in conjunction with their agricultural pursuits. The *Marwaries*, and other petty bankers, are also frequently the channels of communication between the *Thugs*, and there is no doubt of their being the purchasers of the property of the murdered. The religious mendicants throughout the country, occasionally assist in this measure, by becoming the receivers of messages from bands of *Thugs*, to be delivered to the next party that comes that way. With this view, also, they have adopted the practice of forming *Choolahs* or fire-places, of a particular construction, to serve as marks of their progress through the country. When a party of *Thugs* come to a road that branches off in two directions, they adopt the precaution of making a mark, for the guidance of their associates who may come after them, in the following manner. The soil in a convenient spot is carefully smoothed, and the print of a foot is distinctly stamped upon it. A *Thug*, on seeing this mark, which he always searches for, knows, by the direction in which it points, which track has been followed by those that precede him.

The peculiar designation by which they are known, is a point on which the *Thugs* are particularly tenacious, and they attach an importance, and even respectability, to their profession, that they say no other class, of delinquents is entitled to. The denomination of thief is one that is peculiarly obnoxious to them, and they never refrain from soliciting the erasure of the term, and the substitution of that of *Thug*, whenever it may occur in a paper regarding them; declaring that, so far from following so disgraceful a practice as theft, they scorn the name, and can prove themselves to be as honest and trust-worthy as any one else, when occasion requires it. It seems that their ambition to be considered respectable persons, and, with this view, they expend much of their gains on their personal decorations; even those who have been seized, and admitted as informers, are more solicitous about their dress and decent appearance than any thing else. They mostly seem to be men of mild and unobtrusive manners, possessing a cheerfulness of disposition, entirely opposed to the violent passions and ferocious demeanour, that are usually associated with the idea of a professed murderer. Such is the extent to which this dreadful system has been carried, that no idea can be formed of the expenditure of human life, to which it has given occasion, or the immensity of the wealth that has been acquired by its adoption.

When it is taken into consideration, that many of the *Thugs*, already seized, confess to their having, for the last twenty-five and thirty years, annually made a tour, with parties of more than a hundred men, and with no other object than that of murder and rapine; that they boast

of having succcessfully put their tens and twenties to death daily; and that they say an enumeration of all the lives, they have personally assisted in destroying, would swell the catalogue to hundreds, and, as some declare, to thousands, some conception of the horrid reality may be formed. Of the amount of the property that they have yearly made away with, it must be impossible to form any calculation; for, independent of the thousands in ready money, jewels and bullion, the loads of valuable cloths, and every description of merchandize, that continually fall into their hands, the hoondies, that they invariably destroy, must amount to a considerable sum. The impunity with which the *Thugs* have, heretofore, carried on their merciless proceedings, the facility they have possessed of recruiting their numbers, which are restricted to no particular caste or sect, the security they have had of escaping detection, and the ease with which they have usually purchased their release, when seized by the officers of the weak native governments, in whose dominions they usually committed their greatest depredations, have altogether so tended to confirm the system, and to disseminate it to the fearful extent to which it has now attained, that the life of no single traveller, on any of the roads in the country, has been safe, and but a slight chance has been afforded to large parties, of escaping the fangs of the blood thirsty demons, who have frequented them.

For the last four years I have been employed, under the orders of the Supreme Government, in directing the operations that have been carried on in the Dekhan, for the suppression of the horrid crime of *Thuggee*. The public, of course, is aware that a systematic plan is now in operation all over India, for the extirpation of the race of *Thugs*, and sixteen or seventeen officers are engaged in the duty. The information we commenced upon was obtained from *Thugs*, who were arrested in this vicinity, and who came forward and gave intelligence of the existence of the confederacy all over India. They placed on record all the various murders they had assisted at, and told the names, and places of residence, of every member of the community they were acquainted with. These have been sought after and arrested, and as informers were admitted from every successive batch of seizures, we have carried on the chain of evidence, wherever our researches led us. The inhabitants of districts have often been aware of, and connived at, the existence of the *Thugs*, from whom they levied contributions, but my information of the habits of these people has been entirely obtained from those who have confessed.

Nearly two thousand members of the fraternity have been arrested in the upper provinces of Hindostan, Bundlekund, Malwa, Rajpootana, Behar, in the states of Nagpore, Hyderabad and Sattara, and the Bombay Presidency. We have just commenced operations in the Madras territories, and have information of great numbers being resident

therein. The names of between two and three thousand *Thugs*, still at large, in various parts of India, have been denounced to us by the informers.

Unless it be in the Madras provinces and Mysore, *Thuggee*, on a grand scale, is very generally put a stop to; but it is still carried on in many parts of India. Although I have been engaged for four years in the Hyderabad country, yet, within the last six months, I have discovered numerous murders perpetrated there, and arrested many of the *Thugs* who assisted at them. One man alone has given depositions of the murders of upwards of nine hundred individuals, men, women and children, that he was engaged in; and the number of persons, put to death within the last fifteen years, according to the declarations of the informers, would appear incredible, had they not mostly been substantiated, by the disinterment of the bodies buried all over India; often in the most public places; in the centre of villages; in native places of worship, and almost within call of the sentries in a military cantonment. Subjoined is a memorandum of the result of our trials, which will give some idea of the horrid reality.

Almost all the native governments now co-operate with us, though, until they saw that our government had taken up the matter warmly, they did not bestir themselves to suppress the system. I am not aware that there are any penal enactments against them. In the time of the Emperor Akbar, five hundred of them were executed at Delhi, and they have, at various times, been arrested in all the native states, and punished by death, mutilation of hands, feet, nose and ears, and imprisonment. But this had little effect in putting down the practice; it only rendered the *Thugs* more wary.

I think the crime of *Thuggee* is not of modern origin. In Burder's oriental customs there is an allusion to the crime as we know it to have been practised, in explanation of a passage of Scripture. I have not the book by me, so I write from recollection.* He mentions the practice of a woman, or a man in woman's clothes, sitting by the road, apparently in great distress, and alluring a traveller by wailings for some pretended loss, and taking advantage of his proximity to throw a noose over the head of the victim and strangle him. He further mentions, I think, that the cunning woman wore an exceedingly voluminous petticoat, under which the dead body was concealed; exactly similar circumstances are detailed by the *Thugs* who have confessed to us.

* "I find more bitter than death the woman whose heart is snares and nets, and her hands as bands.—Ecclesiastes, vii, 26.

"The following insidious mode of robbery gives a very lively comment upon these words of Solomon.—" The most cunning robbers in the world are in this country. They use a certain slip with a running noose, which they cast with so much sleight about a man's neck when they are within reach of him, that they never fail, so that they strangle him

A *Thug* will leave his home at the foot of the Himalayans, will travel as far south as Mysore, where he will meet *Thugs*, whose faces he never saw before, but of whose existence he has heard from his forefathers. Though unacquainted with the current language of the country, he will be able to communicate through the *Ramasee*, or slang phraseology of *Thugs*, which is the same all over India; will pass the signal of recognition, and, having shared in the booty of an expedition, will return home again. It argues a long prevalence of the system, that this should be the case.

The first trials took place in 1830, when 100 prisoners were tried, for the murder of 70 persons, strangled during two expeditions.

In 1831-32, a second sessions took place, when twenty-six cases of *Thuggee* were brought forward, and 340 *Thugs* were tried, for strangling 328 persons, at various times and places.

In 1833, another sessions took place, when sixteen cases were committed, and 204 *Thugs* were tried, for the murder of 64 persons.

In 1834, a third sessions took place, when forty-five cases were brought forward, and 359 *Thugs* were tried, for the murder of 289 persons.

In 1835, the last sessions took place, when seventy-eight cases were brought forward, and 220 *Thugs* were tried, for strangling 286 persons.

But, in almost all these cases, the murders for which the prisoners were arraigned, formed but a very small portion of the number they had perpetrated during the expedition.

Though a gang is known to have murdered persons at forty different places, during a single expedition, it has not been found necessary to send out parties to exhume the bodies at more than two or three of them, and it is usual only to bring forward those cases for trial, at which the bodies have been found, or the relations of the murdered discovered. Many of the prisoners tried, have followed the practice for forty successive seasons, and small indeed is the proportion of the murders they have engaged in, that we have been able to bring forward.

Another sessions for the trial of *Thugs* is about to take place, but I can give no idea of what are likely to be the results.

in a trice. They have another curious trick also to catch travellers. They send out a handsome woman upon the road, who, with her hair dishevelled, seems to be all in tears; sighing, and complaining of some misfortune which she pretends has befallen her. Now, as she takes the same way as the traveller goes, he easily falls into conversation with her, and finding her beautiful, offers her his assistance, which she accepts: but he hath no sooner taken her up on horseback behind him, but she throws the snare about his neck, and strangles him, or at least stuns him; until the robbers who lie hid come running in to her assistance, and complete what she hath begun."—*Thevenot, part* 3, *p.* 41.

Burder's Oriental Customs, vol. 2, p. 226.

VIII.—*On the Geological position and association of the* Laterite, *or* Iron Clay, *formation of India; with a description of that Rock as it is found at the* Red Hills *near Madras.*—*By* Robert Cole, Esq. *of the Madras Medical Establishment; Secretary to the Asiatic Department of the Madras Literary Society, and Auxiliary Royal Asiatic Society.*

In the volume of Reports of the British Association for the Advancement of Science for 1831-32, occurs the following passage, in the Report on Geology, by the Reverend W. D. Conybeare: " We learn that primitive formations, in which granitic rocks bear the principal proportion, occupy not only the great Himalayan northern chain, but also three-fourths of the entire Peninsula, from the vale of the Ganges below Patna to Cape Comorin; although these rocks are frequently overlaid by a thin crust of laterite—(a ferruginous clay considered as associated with the trap formation.)"*

Now that so little should be known concerning the *laterite,* a mineral so extensively distributed, and offering so peculiar a feature in Indian geology, constitutes an *opprobrium* to the science which it is desirable to efface; and I, therefore, propose to offer my imperfect observations on the position and character of the laterite found in the neighbourhood of Madras, prefaced by an account of what has been written hitherto on this remarkable rock, by way of inciting geological observers, in various parts of India, to note down similar particulars, that so, by the accumulation of observations from various localities, some precise data may be arrived at, by which we may be enabled to assign its true geological position and history, to this singular mineral product.

The name *laterite* was bestowed by Buchanan, who first described it in the following passage. " In all the hills of the country the iron ore is found forming beds, veins, or detached masses, in the stratum of indurated clay that is to be afterwards described, and of which the greater part of the hills of Malabar consists. * * * * * * " What I have called indurated clay is not the mineral so called by Mr. Kirwan, who has not described this of which I am now writing. It seems to be the *Argilla lapidea* of Wallerius I. 395, and is one of the most valuable materials for building. It is diffused in immense masses, without any appearance of stratification, and is placed over the granite that forms the basis of Malayala. It is full of cavities and pores, and contains a very large quantity of iron, in the form of red and yellow ochres. In the mass, while excluded from the air, it is so soft, that any iron instrument readily cuts it, and is dug up in square masses with a pick axe, and immediately cut into the shape wanted with a trowel, or large

* *Reports.* 1832, *p,* 395.

knife. It very soon after becomes as hard as brick, and resists the air and water much better than any bricks that I have seen in India. I have never observed any animal or vegetable exuviæ contained in it, but I have heard that such have been found immersed in its substance. As it is usually cut into the form of bricks for building, in several of the native dialects it is called the brick-stone (Itica culla). Where, however, by the washing away of the soil, part of it has been exposed to the air, and has hardened into a rock, its colour becomes black, and its pores and inequalities give it a kind of resemblance to the skin of a a person affected with cutaneous disorders ; hence, in the Tamul language, it is called *Shuri cull,* or itch-stone. The most proper English name would be *Laterite* from *Lateritis,* the appellation that may be given to it in Science."*

In many places throughout his Journal, Buchanan adverts to the extensive prevalence of the laterite in Malabar and Canara, sometimes over " an amazing extent of surface," to use his own words. It is described by him to be universally found overlaying the granite, and he no where mentions it as associated with any trappean rocks, or with sienite, porphyry, or any other rocks that are classed with that family. In a paper, on the minerals of the Rajmahal cluster of hills, published in the *Gleanings in Science* for January 1831, from Dr. Buchanan's M.S.S. occurs the following passage : " South from Mansa Chandi, at Jajpar on the borders of Virbhum and Murshedabad, there is a hill, which consists chiefly of a clay, readily cut with a knife, but which, on exposure to air, becomes somewhat hard, and is evidently of the same nature with the brick-stones of Malabar, which I have described in my account of Mysore. It is, however, vastly inferior in quality. This clay has a very strong resemblance to the slaggy stone of Mansa Chandi ; and some parts of it, that have hardened into stone, are scarcely distinguishable, except by wanting the slaggy appearance. They must, however, be considered as a kind of breccia, as they contain ferruginous nodules in an argillaceous cement."

The next mention, in point of date, of the mineral we are treating of, is, by Mr. Benjamin Babington,* in a paper on the Geology of the country between Tellicherry and Madras. The whole of the following passage, descriptive of this rock, I transcribe, making no apology for its length as it is very characteristic.

" The face of the country in general below the ghauts is hilly. These hills are low, of a rounded form, and composed of the ferruginous stone so peculiar to India, called by Buchanan laterite. In this porous rock,

* *Journey from Madras through Mysore, Canara and Malabar:—By Francis Buchanan,* M. D. *Vol. 2d, p.* 436 *and p.* 440.

* Trans. of the Geological Society of London, Vol. 5, part 2d, p. 329.

the red ochry part is the matrix, and the kidney shaped interstices are filled with white earth: the whole is alluvial being formed from the washings of the ghaut mountains. In these the hornblende uniformly decays into a red oxyd, and the felspar into porcelain earth. Why these are aggregated in their present form, the red particles forming the matrix, the white the kidneys, I cannot explain. Whenever the alluvial rock, thus formed, is exposed, the white parts are washed away, and a porous ferruginous stone is left behind. Such is the general formation of Malabar. The primitive rocks underneath possibly appear in many places above this Coast: I know them to do so, at the place about midway between Calicut and Tellicherry, at Moy and at Tellicherry. Four or five miles inland from Calicut, there are two low hills, composed of cubic iron ore. These are probably in beds in the primitive rock of the country, though I could perceive nothing but the laterite around. From Tellicherry the laterite forms the hills, until you arrive at the foot of the ghauts, which mountains are composed in general of a compound rock, which I call gneiss, though in some places quartz is intermixed with mica. The mountains formed by this rock, and which line the western side of India, are not of very rugged outline; on the contrary, they are in general wooded to the top: they are very high. Bannason hill, which is among the highest, is said to be 7,000 feet above the sea. This rock is every where in strata highly inclined, almost vertical. It has in some places more quartz, in some more felspar, in some more hornblende; thus varying in colour, and aggregating in streaks. Further on between Peria and Manantoddy, it contains much precious garnet, and is exceedingly tough. In its decay it becomes of an ochry red. Near Manantoddy, there is no fresh exposition of rock: there is indeed a quarry of laterite, about a quarter of a mile from the hill, on the old Madras road. It is worked close to the surface, and the workmen seem never to cut down beyond the depth of a few feet. When the workman has chopped away at the four sides and made the stone flat at the top, he makes a cut or two horizontally underneath, and the mass immediately splits in that direction."

It will be here seen, that, instead of a relation between laterite and trap, or any erupted rocks, being alluded to, a detrital origin is distinctly indicated by this author; which again is stated to be his opinion at p. 336, when speaking of the rocks in Mysore.

" Their (the rocks) decay leaves a whitish soil beneath the surface, I suppose from the quantity of felspar they contain. The dark particles of hornblende become ferruginous, and this is in general the top of the soil, which is reddish. Little fragments also become rounded, and in some cases, as at Bangalore, the whole is settled into the ferruginous stone mentioned as seen on the Malabar Coast. In the detritus of these rocks, it does not seem that particles of felspar are washed

away until they are decomposed; on the contrary, water seems to percolate through the mass, and carry off the other constituents of the sienite, leaving the felspar in a decayed state in mass."

I have now to advert to a mention of this rock by the celebrated Voysey—a name so famed in the history of Indian geology, that I hesitate in delivering an opinion, which is at variance with his notion of the origin of the laterite. The following passage is extracted from a paper dated so long ago as 1820, though only given to the world in 1833.*

"The basalt, which covers the granite to the N. W. of Hyderabad, at first appears only on the summits of some of the hills; the latter rock still occupying the vallies and forming the sides of the mountains. It afterwards gradually increases in extent, until it covers it in all its parts, and granite re-appearing only in the beds of some of the rivers, and forming the base of some isolated peaks. It is sometimes found columnar, the columns being of all sizes, from a foot to a yard and a half in diameter, as at Oudghir, Monegal, &c. It varies from a very compact semi-crystalline rock, resembling hornblende rock, to a porous basalt, which passes into wacken, containing stilbite, mesotype, icthyophthalmite, heliotrope, calcedony, green earth, quartz with crystals of calcarious spar imbedded, the form of which the quartz has taken, demonstrating that this mineral has been the last deposited. The wacken passes into iron clay in the space of a few yards. The latter forms elevated table-land at Beder, which is 2,359 feet above the level of the sea; it closely resembles that of the Red Hills at Madras, Nellore, Singhirikunda (in the two latter on granite), all on the sea coast, but in this instance rests on basalt. I observed in it plumb blue lithomarge, and pisiform iron ore."

Now, if by the *iron clay*, mentioned in this passage, is intended the *laterite* of Buchanan, we must understand the author to attribute one mode of origin to that rock, to the basalt and to the wacken, not only in the Hyderabad country, but in the three other localities, where the mineral is said to prevail "closely resembling" that near Hyderabad. Here then, we may presume, is the authority for considering laterite as "associated with the trap formation." In Mr. Calder's paper on the geology of India, the same character is, indeed, given to this mineral; but as that writer offers no independent proof of his own, but acknowledges having availed himself of Dr. Voysey's unpublished journals, we may presume that he is only stating the opinions of the latter author. The passage I have alluded to in Mr. Calder's paper is as follows. "This trap formation is observed to terminate on the sea coast, a little to the north of Fort Victoria, or Bankot, where it is succeeded by the iron clay or laterite (a contemporaneous rock associating

* *Journal of the Asiatic Society of Bengal* for August 1833, p. 400.

with trap) which from thence extends as the overlying rock, with little interruption, to the extremity of the Peninsula, covering the base of the mountains, and the whole of the narrow belt of land that separates them from the sea, exhibiting a succession of low rounded hills and undulations, and reposing on the primitive rocks, which occasionally protrude above the surface, as at Malwan, Calicut, and some other points, where granite, for a short space, becomes the surface rock; from the main land, the laterite passes over into Ceylon, where it re-appears, under the name of Kabuk, and forms a similar deposit, of some extent, on the shore of that Island. Passing onwards from the western or Malabar Coast, round the extremity of the Peninsula, we leave this extensive iron clay formation, and crossing the granitic plains of Travancore, which are strewed with enormous blocks of primitive rocks, we arrive at the termination of the chain."

Now it seems rather a loose expression to say that laterite is *contemporaneous* with trap, which is considered to be of every geological epoch, from very early eras, to a period subsequent to the deposition of the chalk. If it is meant that the laterite of the south is contemporaneous with the trap of the Deccan, I cannot but think that such a mode of generalization is jumping to conclusions, without any sufficient data whereon to found the assertion. We have no where any accounts (that I am aware of) of any resemblance between the two on the western side of India, except that they each, in their separate localities, overlay primitive rocks. But, if it had been so ordered that secondary formations, containing organic remains, had covered the primary formations of the south, the same argument might have been employed for maintaining their association and contemporary relation with the trap of the north, that the laterite is now said to hold.

Besides, the circumstance of its being an overlaying rock by no means marks the indentity of the two; for, according to the established opinion of the origin of the trap rocks, there must be veins and dykes through which the matter composing them was erupted from below. Now we no where hear of a *vein* of *laterite*; unless, indeed, that title should be erroneously bestowed on a vein of cavernous hæmatitic iron ore, one of the productions which occasionally obtains the character of true laterite, I am inclined to think, for it is a term very laxly applied in Indian geology.

I look upon the statement of Dr. Voysey, quoted above, as by no means invalidating the opinion of the detrital origin of laterite. "Wacke being an earthy kind of trap, and containing the same ingredients as basalt, may be produced in some instances from the disintegration of the latter rock; and when that is the case, its further decomposition would give rise to a rock no wise different from clay."* If this be the

* Encyclopedia Metropolitana, Art. *Geology*, by Phillips and Daubeny, page 753.

case, we may easily suppose how a rock, of the character of laterite, might be formed from the entire decomposition of basalt, containing, in that peculiar locality, more hornblende, and consequently a larger proportion of iron, than usual, or perhaps intermixed with some of the numerous iron ores so abundant over India. Bergman states the average proportion of iron contained in basalts to be 25 per cent, so, perhaps, that quantity alone might be sufficient, to afford the ferruginous components of Voysey's iron clay. Dr. Benza, in his admirable *Geological Sketch of the Neilgherries,* states the red lithomargic earth to result from the decomposition *in situ* of the sientic granite and the hornblende rock, and, he says, " we see in the lithomargic earth what was hornblende changed into a red ochrey substance ; the felspar into a white clay ; the numerous garnets into a crimson coloured clay ; the quartz alone remaining unaltered and undisintegrated." Now it appears to me, that (*mutatis mutandis,* the rocks differing in the two localities), here are all the elements for the composition of laterite such as Voysey encountered in the Hyderabad country, the red ochrey substance, aided, most likely, by ores of iron disintegrated and intermixed, forming the principal component.

But we must not lay it down as an established fact in geology, from the evidence hitherto brought before us, that laterite is a " contemporaneous rock associating with trap." Mr. Calder may have independent proof to offer, but it is necessary to state it. It is, apparently, on his authority that Mr. Conybeare describes the laterite in the terms I have quoted at the commencement of this essay; for the latter gentleman, in his address, cites Mr. Calder's paper as the ablest summary we have of Indian geology.

In the passage I have quoted from Voysey, the mineral at Beder is said closely to resemble that of the Red Hills near Madras. I hope satisfactorily to prove, by and bye, that, at the latter place, it is a conglomerate rock, evidently of detrital origin. The Nellore laterite, of which I have a hand specimen given me by Mr. Malcolmson, is composed of innumerable minute pebbles of quartz, rarely larger than half the size of a pea, sometimes pellucid, generally much rounded; together with red and yellow ochraceous earths. The specimen I have, is not so full of cells and sinuosities, as laterite is usually observed to be. A specimen of white clay, said by Mr. Malcolmson to underlay the laterite at Nellore, is also in my possession. This, most probably, however, forms a very partial substratum, being, perhaps, nothing but a decomposed felspar vein, in the underlaying granitic rocks.*

* Since writing the above, I have been favoured by Colonel Cullen, Commissary General of the Madras Army, with the perusal of a letter

But let me proceed to mention the further notices of this rock which are recorded—Mr. Calder, in the subsequent part of his memoir, relates the occasional occurrence of the laterite, but nothing new is elicited regarding its position and association. From the Caveri to the Pennaar he states, "the surface of the level country seems to consist of the debris of granitic rocks, and plains of marine sand, probably left by the retreat of the sea, with occasional alluvial deposits, and partial beds of *iron clay*, and detached masses of other rocks of the overlaying class. In approaching the Pennaar river the iron clay formation expands over a larger surface*. Passing on to Vizagapatam and Ganjam, granitic rocks, chiefly sienite and gneiss, predominate, and are occasionally covered by laterite†. We trace the laterite, as the overlaying rock, through the district of Medinipúr, and thence continuing northward by Bishenpúr and Bancora to Birbhum, reposing sometimes on sandstone, but more frequently on granite or gneiss."‡

I think it will be admitted, on all hands, that there is very little evidence, in the above testimony of Mr. Calder, to show any relation between the trap formations and laterite. But let me call in other witnesses on the question.

Captain Coulthard, in a paper on the trap formation of the Sagar district,‖ observes; "The iron clay, so easy to be met with every where, would hardly ever satisfy the mineralogist, for it is for the most part amygdaloidal, and not a simple mineral." This is not a very luminous passage; but, it seems to indicate the author's opinion of the conglomerate character of the laterite.

I come now to advert to the description given by the lamented Dr. Turnbull Christie, late of the Madras Medical Establishment: "a gen-

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from Dr. Voysey to his address, dated Hyderabad, 5th November 1820, which contains a passage, couched in much more precise and unequivocal terms than the quotation from the *Journal of the Asiatic Society of Bengal*, and most clearly elucidates his views on the subject.

"The indurated clay you mention is very probably the result of those muddy eruptions so common, and of such extensive occurrence, in S. America. Indeed I am convinced that the green-stone, basalt, wacke, iron clay or laterite, and the indurated clay, have all a common origin, from the insensible degrees by which they pass the one into the other; and that they only differ as to the degree of pressure to which they have been subjected when under fusion."

* Ut supra, p. 9. † *Ibid.* p. 11. ‡ *Ibid.* p. 12.

‖ Asiatic Researches Vol. 18, part 1st p. 58.

tleman whose enthusiasm" says Dr. Jamieson "in the cause of science was of the purest and most disinterested nature, and whose acquirements in natural history were never surpassed by any British naturalist who visited India."*

Having thought it right to re-print Dr. T. Christie's valuable papers in this Journal, I abstain from extracting his opinions here, but refer to the text for the passage on the subject.

We have seen that Buchanan describes the laterite, plainly, as a conglomerate ; and as Dr. Christie quotes that writer, as having first described and designated the rock, without offering any theory of his own regarding its origin, we may fairly conclude that he coincided in the opinion expressed by Buchanan.

The Rev. R. Everest, a scientific and assiduous naturalist in Bengal, has described an iron stone, which I cannot but think must be the laterite, although it will be seen that, at the conclusion of the following passage, the writer draws a distinction between that rock and the one he is describing.

"With the granitic soil are mixed grains of the gravel we before alluded to; and we find blocks of a reddish brown slaggy looking stone, here and there, from which they have evidently been derived. These pieces have, I believe, been called clay iron-stone, a mineral quite different from the clay iron-stone which is found in the English coal districts. It is about the sp. gr. of 2·8, and seems to have been produced by the decomposition of granite, with, perhaps, some magnetic iron. The slaggy appearance is occasioned by its numerous irregular hollows, mammellated inside, and, indeed, some specimens shew much of a stalactitic form. Many grains of quartz are imbedded in it, and the quartz gravel of the granitic soil often has an iron black or red coating, which shows it to have had a similar origin. Those who remember the decomposing state of granite in the neighbourhood of trap rocks, will not be at a loss to account for this. * * * * The iron stone itself, from its mammellated and imperfect stalactitic form, seems to have been at least semi-fluid ; and, from its softness and earthiness, can only have been a deposit from water. So that if we conceive a spring to have issued from the rock, bringing with it this iron clay as a sediment, which gradually agglutinated together, and hardened, we might expect to find such appearances as we now see. * * * * * * * * If we recollect that beds of the red clay, which have been called laterite, and I believe pieces of the accompanying iron-stone, form, as it were, a fringe to great part of the Bay of Bengal, covering the edge of the granite of either peninsula, and lying between it and the sea, we may

* Edinburgh new Philosophical Journal, Vol. XV. p. 156.

have some idea of the causes which have formerly been in operation, from the effects we now see."*

The latest notice of the laterite is by Dr. Benza, a writer who has already contributed more towards a knowledge of the geology of Peninsular India, than any of his precursors, and from whom we may, happily, expect much more.

To his able *Geological Sketch of the Neilgherries*, and to the memoir which adorns the pages of the present number of this Journal, I must refer for his opinions on the origin of the laterite; only stating here, that they will be found confirmatory of the views I have taken of the subject.

Dr. Benza, in a letter to my address, written in May 1834, states his opinion that the laterite, in places where he had met with it, had resulted from the decomposition of granitic, or other crystallized, rocks. And I cannot resist the temptation of transcribing a passage from a letter by Mr. Malcolmson (whose name will carry great weight with it on any scientific subject), written to me in allusion to Dr. Benza's opinions, expressed in the above mentioned letter, which I sent to him for perusal.

"I was much interested by Dr. Benza's remarks on the *laterite*; without a distinction between different kinds, we cannot expect to arrive at a correct theory. Thus the specimen I have got, *with Voysey's label*, is not a conglomerate rock, at least as seen by the naked eye. The red cellular stone used here (*Madras*) is characteristic, and I have little doubt formed as Dr. Benza supposes, by the decomposition of sienite. The same abounds towards Nellore, and not far from that place I found a bed of hornblende slate. At Chicacole there is a black sienitic rock, and, a little up the river, the red stone. At Malacca a strong yellow or white clay is covered with a stone exceedingly like the Madras laterite, and, you know, granite is in the mountains seen from the town. At Rangoon, a little below the surface, a similar stone, but much mixed with sand, is found over the plains; on this lies a very soft sand-stone, apparently formed, and forming, from the annual deposits, and in the puddles much ochre is found. In the Hyderabad country the granite containing iron rapidly decomposes, becomes red and forms a hard mass. The Indoor and Nirmul magnetic iron, also, rapidly becomes red on exposure, and the rock, on being broken and the ore separated by washing, leaves a reddish clay. Veins of quartz pass through the granite and sometimes contain magnetic iron, by which the colour seems to be given to the amethystine quartz. I traced a vein of this kind, in which, while

* *Gleaning's in Science*, May 1831, p. 130, et seq.

the finer crystals were amethysts, there were various masses of a red colour, and cavities and some crystals of a fine red. These appearances seemed to be connected with a large vein of red pisiform iron ore, which led me to entertain a kind of fancy—more I would not yet venture to call it—that the volcanic action, so evident throughout these tracts, had exerted a great influence in the formation of the so-called laterite. In the veins in question, this is often decided, and in others, trap dykes are near, and exactly similar pisiform ore is found in the volcanic *insulated* hills through the granitic tracts. This pisiform structure is frequently visible in the porous or nodular masses. The laterite of Beder is found on granite, but hot springs, and hills capped with trap, are found not far off. I believe no organic remains have been found in the laterite."

I have thus stated all the evidence that I have been able to collect on the geological position and association of this peculiar Indian formation—all the evidence extant, as far as I am aware of, but some accounts may have escaped my research, or be contained in books to which I do not enjoy access. I submit that the foregoing account of what others have written is neither uninteresting nor unimportant, tending, as it does, to point out an error, proceeding from so high a quarter as the individual selected by the British Association for the Advancement of Science to deliver the address, before that august assembly of *savans*, on the present state of geological science : an error, which, propounded *ex cathedra* on such an important occasion, might have led to the establishment of a false view of an important scientific question. The accomplished geologist who was chosen for the highly honorable post of orator before such a brilliant *re-union* of philosophers, will pardon an obscure admirer of the science, for presuming to controvert his opinions: but, in truth, I cannot be said to combat his views, but the theories of those from whom, in the absence of other information, be confessedly derived his notions on the subject.

We have seen, then, that there is very little reason to doubt that the laterite is a mechanical deposit, composed of the *debris* of older rocks; and I shall now proceed to narrate what I have observed of this mineral in the vicinity of Madras.

And here it may be proper to mention, that my attention was first directed thus particularly to the subject, and I was induced to investigate the opinions of others concerning it, after witnessing in one locality, the Red Hills, the palpable character of this rock. Until thus incidentally led, by the opposite evidence there found, to form an opinion of my own on the subject, I had always bowed to the dictum of Voysey, and considered laterite as allied to trap.

The only localities in the immediate vicinity of Madras, as far as I have been able to explore personally, or ascertain from others, where the laterite is found, are the Red Hills and Guindy. Nearer than these two places no hillock arises to break the level uniformity of the plain, on which Madras and its widely scattered gardens are spread out. This flat character of the neighbourhood has most likely given rise to the former of the two places being dignified with the name of *hills ;* under that system of baptismal paradox, which frequently operates in giving names to things for qualities which they do not possess—on the *lucus a non lucendo* principle.

The so-called *Red Hills* are situated about eight miles to the north west of Madras. They are mere undulating grounds, scarcely of appreciable elevation above the surrounding country, the highest eminence not attaining a greater elevation than fifty or sixty feet above the level of the plain. The whole laterite formation occupies a triangular area of about fifty square miles, extending nearly ten miles to the westward of the gravel pits on the east side, the nearest point to Madras, and about seven or eight miles in a northerly direction, towards the Cortillyaar at Jermootapolliam. Of this extensive tract I have only been able to explore an area of not more than three or four square miles.

The line of bearing of these undulations is very irregular, though they generally have, more or less, a direction from S. W. to N. E. From these rising grounds the land descends to what is termed the *Lake*, which is bounded on three sides by the eminences described above, the waters (when there are any) being confined, on the greater portion of the eastern side, by an artificial embankment, or *Bund*, but for which there would be no lake at all, as the country descends on that side towards the sea, it is believed about two and a half feet per mile. To the north east a natural drain for the waters from the higher grounds existed, but it has been filled up, at the place of junction with the lake, by a dam and water sluice, after the manner of an ordinary tank, for the irrigation of the country. The old channel, however, remains, and the banks, in some places fifteen feet high, show the mineral structure of the spot. They are composed of a dark ferruginous stone, arranged in a stratiform manner, presenting seams or partings, two or more feet asunder, parallel to each other, and nearly horizontal. Vertical fissures intersect the seams at right angles, and thus produce prismatic masses of the rock, which give these natural walls something of the semblance of huge artificial masonry. On breaking into the interior of these masses, the rock is palpably a conglomerate. Nodules of various sizes are observed, embedded in a clayey paste, which is very hard and tenacious. These nodules may be picked out, without much

difficulty, when it evidently appears that they are water-worn pebbles, presenting considerable angularity of surface, yet still sufficiently rounded to indicate their having undergone attrition, most likely by the turbulence of an inundation, which bore them away from their original position as parts of a solid rock, and deposited them, in their present conglomerate form, with the mud which now agglutinates them.

The nodules are observed of all dimensions, from the size of a filbert, to masses a foot or more in diameter. Their fracture exhibits the structure of a coarse grained sand stone, or grit, of a deep chocolate, or claret hue (No. 1).* This nodular sand-stone is made up of fragments of quartz (some rounded, but for the most part angular), from a minute sand up to the size of a pea. Added to the quartz, there are occasionally found small masses of a white earth, like lithomarge, appearing to be felspar in a state of decomposition (No. 2). This is found in small nests, here and there ; but I have no doubt that a good deal, minutely subdivided, went to form the paste which united the parts of this conglomerate together. Thirdly, mica is found a constituent of these sand-stone nodules, in very minute scattered leaves.

This sand-stone precisely resembles the specimen from Puddayaram, near Samulcottah, in the Northern Circars, deposited in the Mineralogical Cabinet of the Madras Literary Society, by Dr. Benza, who has thus described its structure and relations in the above locality—" The ferruginous sand-stone is the lowermost, and has a great degree of compactness, so as to fit it for architectural purposes, in which it seems to be largely employed. It is evidently stratified, the strata being nearly horizontal ; the quartz particles are agglutinated by a ferruginous cement.

" The sandstone, nearly in the whole extent of the hillock, supports a lithomarge of a whitish or flesh colour, sometimes having a bluish tint. The stratum of this earth is not very thick, and in many places, it is overlaid by a purple red, compact, slaty hæmatitic iron ore, which passes insensibly in the upper part into a cellular rock, full of tubular sinuosities, very much similar to the laterite. In some places this ore lies immediately over the sand-stone, without the intermediate lithomarge."†

These three minerals, then, are plainly discoverable in these imbedded masses of conglomerate sandstone, but there is an argillo-ferruginous cement uniting the whole together. This cement gives the colour to the entire mass, which is of a purple-red hue, as mentioned

* The Numbers refer to specimens presented to the Society, in illustration of the Paper.

† *Journal of the Asiatic Society of Bengal*, August 1835, p. 437.

above, and sometimes has a bluish tinge (No. 3). Frequently it presents varieties, being either finer or coarser grained (Nos. 4 and 5). The quartz is very abundant ; the lithomargic earth scanty, and the mica is met with in small disseminated scales, " few and far between." The original sand-stone rock, then, of which these nodules are fragments, must have resulted from the fracture and disintegration of some still more ancient crystallized rocks. The sandstone, thus formed, being, in its turn, disrupted, the fragments were tossed and rolled about by some aqueous catastrophe, until they became embedded in this *laterite* (so called), or conglomerate rock which we now see. This view of the case, indicates violent disturbing forces, occurring at two distinct periods of time. Besides the sand-stone, fra gments of ochrey iron ore, to be hereafter mentioned, were found imbedded in the clay.

I was unable to trace the appearance of stratification elsewhere than in this nullah. The ground rises abruptly from its banks to the N. W., forming one of the eminences bounding the lake on that side, and the rock changes character from what I have described above, as occurring in the bed of the nullah. Instead of seeing merely the sandstone nodules embedded in clay, we have a rock possessing the more characteristic qualities of laterite (No. 6). It is rendered cavernous by tortuous cavities, which penetrate it in all directions, sometimes filled with red or yellow ochraceous earth; sometimes with a white clay, like decomposed felspar; but frequently they are quite empty, which is caused, it appears to me, by water percolating from above, carrying with it the soft substance of these earths, the spaces they once filled being thus rendered void (No. 7).

This laterite still shows evident traces of the sand-stone, described as found, in such large fragments, imbedded in the walls of the nullah ; but the pieces are much rounded and comminuted, and are united together by a very compact, heterogeneous, kind of paste, composed apparently of the *debris* of the sandstone itself, of iron ores and of the lithomargic earth. There is no mistaking the sand-stone, which may be picked out, in pieces of the size of a walnut, from the centre of a mass of the laterite, and clearly shews the same structure as that of the nullah (No. 28).

Pebbles, of various kinds of crystallized rocks, are met with, imbedded in the hardest and most compact laterite. On the rising grounds to the north of the lake, I picked out fragments of white quartz rock, some pieces angular, others much rounded (No. 9) ; of very compact siliceous sand-stone, of a red colour, so hard as to be broken difficultly with a heavy hammer (No. 10), and of a white, granular, friable, disintegrating sand-stone (No. 11.). Added to these, a great profusion of fragments of ochrey iron ore, red and brown (No. 12 and 13), a good deal

of it slaty (No. 14), are found imbedded in the less compact kind of laterite, and in the gravel. This ore, I think, contributes to form the more compact laterite, also, but it appears to have been more broken and subdivided, and is therefore not so easily traceable.

The laterite varies very much in appearance. Sometimes it is very hard, compact and heavy, highly ferruginous, of a deep red colour, penetrated in all directions by the sinuosities containing the red and yellow and white earths. In this kind the red sandstone nodules are very distinguishable (No. 15). Some masses are nearly half composed of the white lithomargic earth, which renders it very crumbling (No. 16).

Other varieties exhibit a pisiform structure, numerous rounded pebbles being united together by a yellow clayey cement; this seems of recent origin (No. 17).

Again, in many superficial situations, it is a mere gravel, possessing very little coherence, and, apparently, formed from the *debris* of the laterite itself. The pebbles, composing this gravel, still exhibit the structure of the red conglomerate sand-stone, and of the ochrey iron ore (Nos. 18 and 19).

Innumerable pebbles strew the face of the ground, in all directions, a great number of which, on fracture, display the structure of the nodular imbedded sand-stone (No. 20). I should observe, that I no where saw this sand-stone in any other form than that of fragments imbedded in the laterite, or detached thence, and undergoing another rolling process on the present surface of the ground.

Equally numerous are the scattered fragments of ochrey iron ore, described above. I no where found this substance as a vein, or in mass. It would seem probable that it existed in the original crystallized rocks; and that, under the watery disrupting influences, to which the whole ingredients of the formation have evidently been subjected, this ore was very much comminuted, and the more minute particles contributed the greater portion of the ferruginous paste, so characteristic of all the rocks around.

To the eastward of the lake, in the low grounds, masses of the laterite jut forth from the soil; and no other description of rock is to be seen in any direction.

On Colonel Cullen's property, on the east side of the lake, a trench has recently been cut, ten or twelve feet deep, and thirty or forty feet long. The first five or six feet from the surface consist of a red clay, containing a few fragments of the red conglomerate sand-stone, some nearly a foot in diameter, and, here and there, a piece of the ochrey iron ore. The sub-stratum is a yellowish, tenacious clay, with no imbedded pebbles. An even line of demarcation distinctly divides these two deposits, which do not at all blend into each other.

At the south eastern corner, the nearest point of the laterite formation to Madras, there are numerous pits, where the rock is quarried to furnish material for the repair of the roads. After penetrating several feet of gravel, they come upon the solid laterite, which is broken up with a crow-bar, for which the employment of very great force is necessary, the mass being previously softened by the affusion of water. It no where is of the soft consistence of the laterite of Malabar, as described by Buchanan and Babington.

The laterite in this locality (No. 21) varies in no respect from that to the northward of the lake. It is all of the true compact kind, and I no where saw the large masses of conglomerate sand-stone imbedded in the clay, witnessed in the nullah ; nor was there any appearance of stratification.

The same kinds of imbedded rocky fragments were found also at this spot, with the following additions :

1st. Granite, composed of quartz, felspar and mica : a single, small, angular fragment (No. 22). 2d. Sienite, or sienitic granite, composed of quartz, felspar and hornblende ; a large angular piece, in a disintegrating state (No. 23). 3d. A fine grained green-stone ; a large fragment (No. 24). These were found among the fragments, which the workmen had produced by their operations in the pits, and I cannot say whether they were derived from the gravel or the compact laterite.

I have met with no calcarious matter in the localities I have visited, though I made particular enquiries on this point, as Dr. Heyne mentions the existence of that mineral at the Red Hills.* I picked up a single fragment of botryoidal kankar, to the south of the lake, but no where found it *in situ.*

At the top of one of the lower eminences, imbedded in the gravel, about a foot and a half from the surface, I found fragments of a rude pottery, the composition of which is of the coarsest kind, being a dark green paste, containing numerous grains of quartz (No. 25). These fragments, thirty or forty in number, were irregularly disposed, some pieces being vertically placed, others horizontally, shewing a confused arrangement in the gravelly matrix. This circumstance proves the gravel to be of recent origin.

Dr. Benza informs me that fragments of pottery of precisely similar composition, are found in the cairns on the Neilgherry Hills. It appears to me to resemble none of modern manufacture.

It is singular that no organic remains have been hitherto found in the laterite itself, or in the gravel deposits. We might suppose that, if the waters which held the matters composing these conglomerates in suspension, had moved with great turbulence and rapidity, so great a

* *Tracts on India, p.* 114.

degree of trituration would be produced, as to be unfavourable to the preservation of animal exuviæ. But the angularity of most of the pebbles forbids this idea.

Are we to suppose, then, that the laterite is so ancient as to have been formed from the *debris* of primary rocks, before the existence of life on our Planet?

Or, is its non-fossiliferous character a proof of its volcanic origin? It may be remarked, that the existence of imbedded fragments of crystallized rocks, by no means militates against the eruptive theory. Portions of the rocks, traversed by the volcanic vent, may be thrown out. "The Chevalier Monticelli's invaluable collection of Vesuvian products at Naples, contains a great variety of these substances, among which may be seen fragments of the compact lime-stones of the district, with organic remains in them."*

Careful observation in many localities, and examination of the laterite in the various forms it assumes, are necessary to enable us to arrive at positive conclusions on this subject. It is particularly desirable that an examination of the neighbourhood of Beder, in the Hyderabad territory, should be made, with this object in view; and any of my readers, whose travels lead them in that direction, are particularly requested to collect specimens in illustration of this interesting question. Should an *iron clay* be observed to pass into, or gradually change to, any other more compact description of rock, fragments should be broken off from various points, so as to show the structure of the two kinds separately, and the change each undergoes on coming in contact with, or changing into, the other.

We know that boulders travel many hundreds of miles from their parent rocks, so that there need be no difficulty about assigning a locality to the fragments which I have described as imbedded in the laterite and the gravel. St. Thomas' Mount and Palaveram Hills are the nearest to the spot, being about fifteen miles distant. They are composed of varieties of granitic and hornblende rocks. About fifty miles to the N. W. a picturesque hilly outline is visible, the most southerly point of which is the well known Nagary nose. This outline appears as if it was formed by one continued range of mountains; but, besides the Nagary hills, it includes the Ramgherry ridge, that of Cumbaucum-droog, &c. Primary rocks, trap in abundance, compact quartzose sand-stone, lime-stone, clay slate, &c. prevail in this direction; also laterite, and conglomerate rocks, or pudding stones.

Economical uses of the laterite. Vast quantities of this rock are quarried for making roads, for which purpose it is admirably

* De la Beche's Geological Manual, 3d Edition, p. 138.

adapted, though it produces a very disfiguring red dust, wherever it is employed. This inconvenience might be diminished, I should think, without detriment to the roads, by employing a large proportion of the decaying granitic rock, found in such abundance in the bed of the Adyar river. This rock is binary granite, or pegmatite, the felspathic component of which is in large proportion, and decomposes into *kaolin*, or porcelain earth. A large admixture of this with the iron clay, might be an advantageous change from the present system.

I observe that the active and intelligent Engineer officer, who superintends the road department at the Presidency, has made the experiment, on a small patch of road, of McAdam's system of formation; and it has succeeded there admirably. The rock he has selected is the pegmatite, in its undecomposed state, and nothing could answer better than it has done. The spot on which this has been tried is a crowded thorough-fare; I think it would not answer on the less frequented roads, as the attrition, from the light carriages in use, would not be sufficient to grind down the surface to an even condition. But for bullock bandy roads it would be excellent.

But, to return to the economical uses of the laterite. As a building material it is not at all in vogue at the present day, though its durability is attested by its present condition in most old buildings about Madras, where it has been extensively employed; as in St. Mary's Church, and some other buildings, in the Fort, and for the piers and coping stones of many of the bridges, over the rivers on Choultry Plain, etc.

The whole basement of St. Mary's Church is formed of laterite, and the stone has retained the sharpest angle which the chisel gave to it upwards of one hundred and fifty years ago. I think that it would be very judicious, on many occasions, to substitute this iron stone for bricks plastered with perishable *chunam*, which demands constant renovation, entailing perpetual expense. Twenty slabs, two feet long, one foot broad and six inches thick, may be had in Madras for one pagoda.

IX.—*Genealogy of the Kings of the Mahomedan dynasty in Achin, from the 601st year of the Hejira to the present time. Extracted from a Malayan MS. entitled "Adat Achi," usages of the kingdom of Achin; &c.*—*By* T. J. Newbold, Lieut. A. D. C.

(*Continued from Vol. II. p. 57.*)

18. Sultan Ali Moghayet Shah. A. H. 1011. After a short reign, of little more than three years, died A. H. 1015.

19. (*a*) Maharaj Direm Wangsa Tuan, or Sri Sultan Iscander Mùda. A. H. 1015. Died A. H. 1045. The kingdom of Achin attained the zenith of its power during this monarch's reign. From this time, also, may be dated its gradual decline before the increasing influence of European enterprize.

20. Sultan Mogul, or Sultan Ala-uddin Moghayet Shah, A. H. 1045, son-in-law of the preceding; reigned nearly four years; died A. H. 1048.

21. Sultana Taj-al-Alum Suffiat-ud-din. A. H. 1048. Daughter and only child of Sultan Iscander Mùda, and widow of the preceding; died A. H. 1084.

With Taj-al-Alum commenced the celebrated female dynasty in Achin, terminating in the person of Kemálet Shah.

22. Sultana Núr-al-Alum Nafiyet Uddin, A. H. 1084. Died A. H. 1036. During her reign the kingdom was divided into three districts, or *Saghis*. The first comprising twenty-two *múkims*, or parishes; the second twenty-six, and the third thirty-five.

23. Sultana Mayet Shah, commenced her reign in 1086, A. H. and died A. H. 1090.

24. Sultana Kemálet Shah, A. H. 1090, reigned a little more than eleven years. She was deposed in 1101 by her ministers and subjects, in consequence of the receipt of a letter from Mecca, from Cazi Moollah-ul-Adil, which declared the rule of females repugnant to the doctrine of the Koran, and subversive of the tenets of Islam.

(*a*) According to Mr. Marsden, this Prince evinced much friendship towards the Dutch during the commencement of his reign. In the year 1613, A. D. he allowed the English to establish a factory, with many indulgences; in consequence of a letter and present from James the First.

In his answer to James (a translation of which Purchas gives) he styles himself king of all Sumatra. He expressed a strong desire that the king of England should send him one of his country-women to wife, promising to make her eldest son king of all the Pepper countries, that so the English might be supplied with that commodity by a monarch of their own. Towards the close of his reign he grew jealous of the rising power of Holland, England and Portugal, and attempted to eject all subjects of these nations from Sumatra.

Thus terminated this singular rule of females, (*b*) to the exclusion of males, in Achin; acquiesced in, according to some writers, by the nobles and people, on account of their finding feminine sway more endurable than that of males. This is stated with perfect gravity.

25. Sultan Badr-al-Alum Sherif Hasim Jemal Uddin, A. H. 1111. Retired from the cares of government 1113, A. H. He is said to have been originally a priest.

26. Sultan Perkassa-Alum Sherif Al Mactawi, Ibn Sherif, Ibn Ibrahim, A. H. 1113, nephew of the last Sultana, reigned a few months only, and was succeeded by the son of Badr-al-Alum, under the title of Badr-al-Munir.

27. Sultan Jemal-al-Alum, Badr-al-Munir. A. H. 1115. Deposed A. H. 1139 by his subjects.

He escaped by sea to Pedir under cover of the night. After an interregnum of twenty-two days, Maharaj of Kampong Prang was elected under the title of Amma-uddin Shah.

28. Sultan Jouhar-al Alum, Amma-uddin Shah. A. H. 1139. Died in the same year, twenty-one days after his accession to the throne. The four *múkims* elected Undaye Tebbing under the title of Shems-al-Alum.

29. Sultan Shems-al-Alum. A. H. 1139. This monarch was deposed, thirty days after his accession, by his ministers and subjects.

Maharaja Selah Malayu was elected in his stead by the unanimous voice of the *Hulubalangs*, and the three *Saghis*, under the title of Ahmed Shah.

30. Sultan Ala-uddin Ahmed Shah. A. H. 1139. Reigned upwards of eight years, and died A. H. 1148. On his decease the de-

(*b*) Regarding this period of Achinese history, we find the following passage in Marsden.

"In proportion as the political importance of the kingdom declined, its history becomes obscure. There are no accounts to be met with of the transactions of this reign, and it is probable that Acheen took no active part in the affairs of the neighbouring powers, but suffered the Dutch to remain in quiet possession of Malacca. Even the period of its duration is not marked. In 1688 a queen of Acheen died, but as she is described by the English gentlemen, who went there on an embassy from Madras, in 1684, to be then about forty years of age, she must have been a successor, and perhaps not the immediate one, of Peducka's widow. These persons declare their suspicions, which were suggested to them by a doubt prevailing amongst the inhabitants, that this sovereign was not a real queen, but an eunuch dressed up in female apparel, and imposed on the public by the artifices of the *orang cayos.* But as such a cheat, though managed with every semblance of reality (which they observe was the case), could not be carried on for any number of years without detection, and as the same idea does not appear to have been entertained at any other period, it is probable they were mistaken in their surmise.

"Her person they describe to have been large, and her voice surprisingly strong, but not manly. The purport of the embassy was to obtain liberty to erect a fortification in her territory, which she peremptorily refused, being contrary to the established rules of the kingdom. The English however finally succeeded in re-establishing their factory."

posed Prince, Sultan Jemal-al-Alum, returned on the 5th of Mohurrum, and was received by some of the nobles. After a civil war, which raged during four months, a peace was concluded, and the son of Ahmed Shah, Puchit Aivap, elected king, under the title of Johan Shah.

31. Ala-uddin Johan Shah. A. H. 1172. After a war with the *Panglimas*, and other chiefs of the kingdom, Ala-uddin was eventually compelled to abdicate. He died in retirement, A. H. 1174. After his abdication, the nobles and heads of the twenty-two *múkims*, held a public assembly in the principal mosque, in order to fix upon a successor. A stormy discussion ensued leading to a civil war, in which, Tuanku Rajah, a son of Ala-uddin, lost his life. Peace was finally restored, and a brother of Tuanku Rajah, Mahmud Shah, raised to the throne.

32. Sultan Ala-uddin Mahmud Shah. A. H. 1174. War shortly broke out again among the factious nobles, and the Sultan was compelled to fly, by Maharaja Laboi, who usurped the throne. A. H. 1177.

33. Maharaja Laboi. A. H. 1177. Was assassinated, after a reign of two years and seven months. The chiefs and people, at a public convention, propose to recal Sultan Mahmud Shah which is agreed to by the *Hulubalangs*, the heads of the *mukims*, the *Pertamas*, Purba Wangsa, Nanat Sitti and the Imaums. Mahmud Shah resumed the throne, but after a reign of little more than six years, was obliged to make his escape to Telok Anga, in consequence of a night attack made upon him by the chiefs of twenty-two *mukims*, who elected

34. Andhina Lela in his stead. Andhina dying shortly after, Mahmud Shah again took the field; and, having gained over a considerable body of the nobles, he advanced against Rajah Andhina (another candidate for the throne), and, after a short contest, completely defeated him. Mahmud Shah was thus, a third time, re-established in his seat on the throne of Achin. He died on the seventh day of the moon Jemadi-al-Akhir. A. H. 1195.

35. Sultan Ala-uddin Mahomed Shah. A. H. 1195. Son of the preceding, succeeded by Jouhar Alum Shah, his son. A. H. 1209.

36. Jouhar Alum Shah, after a reign of twenty-one years, fled from Passi to Prince of Wales' Island (Pulo Penang), on the 1st day of the Mohurrum. A. H. 1231.

37. Sultan-us-Sherif Saif-al-Alum Shah. A. H. 1235. In the year of the Hejira 1235, corresponding with the year *Alif*, on the 12th of the moon Zualhadj, at the hour of ten in the morning, the three *Saghis*, and all the people of Achin, assembled for the coronation of this monarch by the title as mentioned above.

38. Sultan Bayang succeeds. A. H. 1242. He was a son of the late Jouhar Alum Shah.

It may be here remarked that, in 1829, Syed Hussain, a native merchant of Penang, of great wealth, and considerable influence among the Achinese chiefs, encouraged by the anarchy prevailing, put forth his claims to the crown, and actually caused his son, Saif-al-Alum, as just mentioned, to be elected king by the three *Saghis*, in room of the rightful prince Jouhar Alum Shah, who fled to Penang. The late Sir Stamford Raffles, and Lieut. Colonel Coombs (then Capt. Coombs) of the Madras service, were joined in a commission by the Marquis of Hastings to decide upon the claims of Syed Hussain, which, after a long investigation, were found to be wholly groundless. Jouhar Alum was consequently reinstated, and a commercial treaty concluded with him, together with the privilege of having a Resident and establishment at Achin. This, however, has been since annulled by the impolitic treaty between Great Britain and Holland, done at London, March 17th, 1824; by which the English settlements in Sumatra were ceded to Holland, from the 1st March 1825; and wherein it was stipulated, that no British settlement should be formed in future on the Island of Sumatra, nor any treaty concluded by British authority, with any native prince, chief or state therein.

On Jouhar Alum's death, a few years ago, his son, the present prince, Sultan Bayang, succeeded. Saif-al-Alum retired to Penang, and is since dead. Achin at present is in a state of anarchy. The little authority formerly exercised by its prince, has been usurped by the *Saghis* and heads of tribes; its trade with our ports is still considerable, though much diminished, and, indeed, in a fair way to become annihilated altogether, if more attention is not paid to scouring the seas of the numerous pirates by which they are infested, and who are daily becoming more presumptuous, from impunity.

The Dutch, who are now strenuously attempting the subjection of the whole of Sumatra, will probably find Achin an easy conquest, in consequence of the divided state of its councils: that is, *if* the *Menangcabowes* and cannibal Battas, do not prevent the Hollanders from ever penetrating so far. This, by the latest accounts, seems to be the case; the Dutch having sustained repeated losses.

X.—*Observations on original and derived Languages.—By the* Revd. BERNHARD SCHMID.

1. There is perhaps no country on earth, where so many individuals, of all ranks and ages, are busily engaged in learning languages, as in India. Hindus and Mahomedans, from Cape Comorin to Cabul, and from Bombay to Assam, are eager in the study of English, and many of them acquire few or more vernacular dialects besides. Every military gentleman, and many others, are in duty bound to learn, not only Hindustani, but, frequently, Arabic and Persian also; and every gentleman of the Civil Service has to acquire the knowledge of some Indian dialects, either branches, or sister-languages, of the Sanscrit. Some remarks on the nature of languages will, therefore, it is presumed, not be wholly uninteresting or useless to the readers of the *Journal of Literature and Science.*

2. The languages of the earth are either *original, i. e.* formed by a nation through their own mental exertion,—or *derived, i. e.* formed by the *violent* interference and intermixture of one or more other languages. Hence *original languages* will always be found to be more consistent with themselves, and logical, than *derived languages*, which latter possess a great proportion of words, the various meanings and application of which are arbitrary, and the arrangement of which is either quite the reverse of the construction of an *original* language, or quite undefined, and solely regulated, in each individual period, by convenience and circumstances.

3. From these observations it follows, that the expressions, *mother* and *daughter-languages*, mark very different relationships. For, there may exist *original* languages to which no language now existing owes its *origin*, and which is, therefore, *not a mother-tongue;* many a *derived* language may be the mother of others, and is, consequently, a *mother-tongue;* and many a *daughter-language* is correctly classified under the head of *original languages,* if such a language has not suffered violent intrusion from the language of a conqueror, or from other circumstances.

4. A striking mark of an *original language* is found in the *construction:* all words which modify, or more accurately describe, the subject, stand *before* the word which is thus modified; consequently, the adjective and the genitive stand before their noun, the adverb before the verb, the dative, accusative and ablative before their regimen, the cause or instrument before its effect, the motive is mentioned before the action, and the thing compared before that to which it is similar; whereas, in a *derived* language, the modifying words stand generally *after* the words which are modified or defined.

5. In order to illustrate this fact, let us compare two languages, the respective histories of which are sufficiently known, viz. the *German* and the *French*. That the German is an *original* language can be clearly proved. Tacitus says of the Teutonic tribes: "The people of Germany appear to me indigenous, and free from intermixture with foreigners, either as settlers or casual visitants." And again, "I concur in opinion with those who suppose the Germans never to have inter-married with other nations; but to be a race, pure, unmixed, and stamped with a distinct character. Hence a family likeness pervades the whole, though their numbers are so great; eyes stern and blue; ruddy hair; large bodies." And there exists not the least intimation, which could make us suppose that this roving and warlike race, at any period before their emigration from the high lands of Asia, had been fixed (as cultivators of land, or otherwise) in any country, and violently subjugated by any other tribe, whereby the originality of their language could have suffered;—and it is certain that, *after* Tacitus, neither the Romans, nor any other nation, ever subdued them and forced another language upon them. The Gauls, on the contrary, were quite trampled under foot by the Romans, the Latin language was forced upon them, and adopted by the Goths and Franks, their conquerors, whose numbers were too small, to be able to force their respective dialects upon them.

Now, to exemplify the difference between the construction of an *original* and of a *derived* language, let us take the phrase: *Les montagnes de la Suisse couvertes de glace et de neige;* where the subject, *montagnes,* stands first; the modifications, *de la Suisse* and *couvertes,* follow, and the word *couvertes* is again followed by its modifications or definitions, *de glace et de neige.* The construction, in German, is quite the reverse: *Die mit eis und schnee bedeckten Schweizerberge,* (or, spelled and pronounced strictly according to the Romanizing system, *Di mit eis und shné bedeckten Shveitzerberge*); and the most ancient British writers, who have still preserved the genius of the old Saxon original language, would have said, *the ice and snow-clad Swiss mountains.*

6. It would be superfluous to adduce more instances; suffice it to observe, that this short German phrase is the type of the longest period of a truly original language, which, in conformity with the rule given above, must invariably conclude its periods with the inflected verb *(verbum finitum)*; and the more consistently this construction is carried through in a language, the more justly it lays claim to the honour of being a purely *original* one; and, consequently, the more accurately and strictly an author, in his compositions, observes this great principle, not only in the position of his words, but also in the

moulding and arrangement of his *ideas* and periods, the more correct, idiomatical and perspicuous, will be his style.

7. The construction of the Tamul, Maleiàlam, Karnàtaka and Telugu (I think also that of the Konkanese and Orissa), is most strictly conformed to the rules of a genuine *original* language—as the verb invariably concludes the sentence, and although many *Sanscrit* words are found in these dialects, yet it is evident that, before the Brahmins gained any influence over these tribes, their dialects were grammatically formed and fixed, nor did the Brahminical tribe ever *violently* interfere in their formation.

The construction of the Sanscrit, German and Bohemian languages (the *latter* is the only dialect of the Slavonic tribes with which I am acquainted), although doubtless *original* languages, are not equally consistent and strict in the arrangement of their words (e. g. the verb does not conclude the sentence) and must have, *in a certain degree*, suffered from the intermixture of other languages, as by close and frequent intercourse with other tribes. In some such manner as we find in) old German national poëms of the year 1100 or 1200 A. D. until 1500, instead of, *mein Brúder* (my brother), *der Brúder mein* (il fratello mio &c.; in consequence of the very frequent residence of the Germans in Italy, when the heads of the Germanic empire were constantly chosen Emperors of Rome.

The construction of the Hebrew, Arabic and cognate Shemitic tongues, being diametrically opposite to that of the just mentioned languages, proves that these tongues are *not original*; and the cause of it is easily explicable, from the history of these tribes, as they were always, particularly in the earlier periods, living quite intermixed with other nations, and frequently subjugated by them; their dialects must, consequently, have suffered *violence* from the languages of their respective neighbours and conquerors.

The Persian and Hindustani belong likewise to the class of *derived* languages, although the construction of the latter, having principally been fixed amongst Hindu nations, whose vernacular languages are *original*, has, in a great measure, preserved the character of an original language.

8. From the foregoing observations it will appear, that it is not a paradox to say that the Greek and Latin languages, although themselves mother-tongues, are *derived languages*; and their construction, being without any rule and consistency, is a stubborn proof that they are so.

It is, however, a remarkable fact that the Latin poets prefer putting, as far as the fetters of the metre allow it, the genitive and the adjective before the substantive to which they belong—strictly according to the

genius of an *original* language. To illustrate this, I hope I shall be pardoned if I introduce some examples from Horace, marking with italics those words which are in point.

Altera jam teritur bellis civilibus *ætas,*
Suis et *ipsa Roma viribus ruit.*
Quam neque *finitimi* valuerunt perdere *Marsi,*
Minacis aut *Etrusca Porsenæ manus ;*
Æmula nec *virtus* Càpuæ, nec Spartacus acer,
Novisque rebus infidelis Allobrox ;
Nec *fera cæruleâ* domuit *Gërmania pube,*
Parentibusque *abominatus Hannibal* ;
Impia perdemus *devoti sanguinis ætas,*
Ferisque rursus occupabitur solum.

I would here remark that, according to the genius of a strictly *original* languarge, it ought to be *Càpuæ virtus*, but the poet placed the genitive after its substantive, merely for convenience sake, as the caesura would not have been so beautiful by far. Similar passages we find in Liber II, Ode 12, Stroph. 1 and 2—L. III, Ode 3, 45 and 48 ver.—L. III, Ode 1st, 11th and 15th Strophes ; but I cannot omit one, which is a particularly fine specimen of the accuracy with which the Roman Poets have sometimes observed the construction of an original language, viz. L. II, Ode 14.

Linquenda tellus, et domus, et *placens*
Uxor ; neque harum *quas colis, arborum*
Te, præter *invisas cupressos,*
Ulla brevem dominum sequetur.

Here we have *exactly* the Tamul construction ; and, I would observe by the way, that, because in a Tamul translation of the phrase *quas colis arborum ulla,* the words *quas colis,* are rendered by the participle, as it were, *tu colens arborum,* or *tu colentium arborum,* i. e. *a te cultarum arborum,*—and because, in the Tamul language, the verb with the relative (like *quas colis*) must always be the participle, and must stand *before* the verb which it more accurately describes, *the Tamülians have no relative noun at all,* as they never stand in need of any. Also, in that respect, the Latin has preserved a fragment of a strictly original language, as they say *mecum, secum, nobiscum,* putting the preposition, which is nothing but a modification, or a more accurate definition, of the noun, after it, just as in the *original* Hindu languages.

9. If I am not mistaken, the Greek Poets are by no means so careful to observe this rule of construction, and even many compound words

in the Greek language are faulty, and not analagous to the principles and genius of an *original* language: e. g. if Τιμοθεος (romanized *Tímotheos, colens Deum*) is a correct compound, *Christophoros* (ferens Christum) must be a faulty one, and it ought to be *Theotímôn*, (or rather *Theotímês*). And if *Theotímos* means *honoratus a deo* (deis), and if *Theopompos* means *missus a deis*, then *Christophoros* ought consistently to be rendered *carried by Christ*(which rendering would be contrary to the Legend which explains the meaning of the word). It is evident from this, that the Greek nation, having arisen out of several different tribes, by free and voluntary intermixture, not by subjugation, and their language having been formed by the amalgamation (if I be allowed to use this expression) of various heterogeneous languages, have infinitely gained in richness, variety and unshackled freedom of their language, but have lost the tact and instinctive feeling of the analogy and logical consistency which a *purely original* language possesses in a remarkable degree. Thus they say, e. g. *theomachos* (*deo repugnans*) and *theomachia* (*deorun pugna*); hence, also, the word *theomisés* is rendered both by *deo invisus*, and by *qui odit deum.* Such irregularities in compounding words do not occur in any *truly original* language; certainly not in the the German.

The pure Latin tolerates comparatively few compounds, and these few will, I suppose, be found correct ones—an additional presumptive proof that the languages out of which the Latin was formed, were in a higher degree *original* than those to which the Greek owes its origin. But, had the Latin been formed from *its own* materials, without the intermixture of a great proportion of foreign words and idioms, the Romans would have retained the ability or the inclination to form compound words in abundance, just as the Sanscrit, Greek and German. In *this* respect, therefore, the Latin is rather similar to her *daughter-languages*, the Italian, French, &c. and leaves to the Greek the palm of originality. This also can be accounted for, but I refrain from adding any thing now, from fear of being tedious.

The Tamul can form nearly any compound, and the ancient writers made free use of this liberty, but the love of logical clearness (a common property of *original* languages), induces them to be more sparing of them in their modern prose compositions.

10. A scond mark by which *original* and *derived* languages are distinguished from each other, is the *accent.*

Since a truly *original* language forms its words by compounding elementary words, or syllables* the meanings of which are distinctly

*E. g. *be*, in bedew, besprinkle, bespeak, betray, expresses *a doing on all sides*, or fully, abundantly ;—*for*, as in forsake, forlorn, forswear, expresses *a destroying*, just as *per* in perdo, perjuro, pereo ;—and as *ver* in German.

known to the nation, it is natural that the principal word or syllable, of of each word thus compounded, should be distinguished in speaking by a stong emphasis (accent). Nations, on the contrary, who possess a *derived* language, having more or less lost a distinct knowledge of the meaning of the component parts of the words, which they have received from their conquerors, place the emphasis (accent) on wrong syllables, or have no accent at all. According to this criterion, the French has, in a high degree, the character of a derived language, because it has no accent : and the highest praise which Frenchmen can give to a foreigner, who speaks their language, is, *il parle sans accent.*

According to the same criterion, the Teutonic dialects have eminently the character and spirit of an *original* language, as the accent lies invariably on the radical syllable, or the principal elementary word, of a compound ; and if in a compound occur two elementary words of equal importance, they are both equally accented, (e. g. *Genúgthúung*, enough doing, or satisfying ; *Réchtscháffenheit* right-shapedness or honesty ; *Aúfríchtigkeit*, uprightness. And, likewise, the British nation have preserved, in a high degree, the independently thinking spirit of their Saxon ancestors, and the powerful accent of a free nation, as they place the accent mostly on the radical and principal syllable, even of those words which are derived from the Latin ; thus they say *cápable,* and not cāpāble, as the French ; *invíolable* (the *vi* accented, because it comes from the Latin *vis) ; dĕpŏsĭtăry*, and not *dépósitáire,* or (*deppossittaire*) as the French pronounce it.

The rules of the Greek accentuation show evidently that this language is *not original,* and it is strange that the rules of the Bohemian accent (although an original language) are rather analogous to those of the Greek. I greatly doubt whether the Romans had any accent ; and if the Tamülians can be said to have any, it is certainly very weak, and is not placed on the principal syllable.

I doubt not a philosophical inquiry, into the causes of this difference of the accent of the various languages, may lead to interesting and curious psychological results.

11. In conclusion, I beg leave to make one general observation, particularly in reference to the four principal vernacular languages of the Madras Presidency.

Upon a right understanding of the fundamental and essential principle of the construction of a language, depends, in a very great measure, the clearness and impressiveness of an address or composition, and if, in an original language, the arrangement of the parts of a period the disposition of the periods, and the whole shaping and moulding of the ideas, be not conformed to the principle laid down in para. 4 ; an

address or composition, although in itself logical, idiomatic and excellent, will appear to a native as covered with a mist. He sees the objects, but not distinctly; each sentence he understands, but not always the connexion with what precedes or follows; his mind is wearied, and his attention flags. I know, from my own experience, that, after having studied one of the south Indian dialects for years, before I obtained a clear understanding of these principles, I was frequently uncertain how to arrange my periods and to shape my ideas, so as to become perspicuous and impressive, or even intelligible, to the natives.

A proof that the real nature of the construction of the dialects of southern India, is not yet sufficiently understood, is, that we hear so often in conversation, and see so often in print, the word *énendrál* or *yénanderé*,—whereas it follows, from the above observations, that all parts or clauses of a period, beginning in English with *for*, *because* or *as*, containing the cause of some effect, must invariably stand *before* that effect. One, therefore, who uses *énendrál* or *yénanderé*, betrays himself, in most cases, as an unidiomatic speaker or writer. Suffice it to mention only one instance, which just occurs to my mind. If the construction of the words, "Jesus saw two brethren, Simon and Andrew, casting their nets in the sea, *for they were fishers*," be closely followed in the Tamul translation, thus—Yésu Símóneium Andréáveium tangel valeigelei kadelité pótu kolla kandar *énendrál* avergel mín püdickiravergeláirundàrgel, it would be unidiomatical, and a Tamülian would be inclined to suppose, that *their being fishers*, was the *reason* that Jesus *saw* them. Only if a very important sentence is to be enounced, or a long chain of reasonings is to be introduced, this construction, and the use of *énendrál* may be allowable, and is, perhaps, unavoidable; but, in the present, and most other, cases, the construction of the sentence must be *altered*. Thus—*Jesus saw Simon and Andrew* (they) *being fishers, casting their nets in the sea;* but even this change is not *sufficiently* conformable to the spirit of an original language, for, after all, the clause, *for they were fishers*, is merely a more accurate description or definition of the subjects—Simon and Andrew—and the Tamul period is most clear, concise and unembarrassed, if we say, Jesus saw *the fishers* Simon and Andrew, etc. (mín püdickiravergelágia Símóneium Andréáveium kandár) which *quite* expresses the meaning of the Apostle, although, at first sight, it might appear an unnecessary and unwarrantable departure from the original.

XI.—*On the Metamorphoses of the Musquito.—By* W. GILCHRIST, Esq. *of the Madras Medical Establishment.*

The following are a few observations I lately made on the successive forms the Musquito assumes, before becoming the troublesome insect known under that name. Not having, at present, an opportunity of learning whether they add any thing new to the natural history of the insect, I trust, if they do not, this communication may be put aside.*

The Musquito has three stages of existence, in two of which it is a water insect, in the third the well known winged one—6th May, 6 A. M. I observed several Musquitos on the surface of some stagnant water, each in close proximity to a yellowish substance, which, when viewed through a microscope, proved to be a collection of eggs that the musquitos were depositing ; each collection, though consisting of not fewer than one hundred eggs, did not exceed three twentieths of an inch in length, and about one twentieth of an inch in breadth. These eggs were arranged in lines, standing on end, and were each about 1-40th of an inch long; the lower end being larger than the upper, so that the upper surface of the collection was somewhat concave.

A few of these collections of ova were carefully introduced, with some of the water on which they floated, into a tumbler, and placed under a glass shade. Excepting a change of colour, from a yellow to a dark brownish grey, which occurred within six hours after being put into the tumbler, no visible alteration took place, till two days and a half, when the water was found to swarm with animalculæ. The shells of the ova were still adherent, as when first observed. On examining one minutely, the larger, or under, end was found to have opened, like a lid, to allow the insect to escape into the water. A lady's thimble, furnished with a lid, would resemble exactly the appearance of what is being described. The design of having the lids placed at the bottom, is, evidently, to allow the newly hatched animal-

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* The information, contained in this interesting communication, cannot be supposed, in the present advanced state of our knowledge of natural history, to be altogether new, but several observations are perfectly original, as far as we are able to ascertain, and would entitle the paper to admission into the pages of any Journal devoted to matters of science. Moreover, whether novel or not, the highly intelligent author is entitled to the full credit of *independent observation*, not having access to books on the subject, in the retired station (Hoonsoor) at which he is resident ; and we gladly, therefore, give a place to the article, not only on account of its intrinsic value and interest, but as an incentive to others, to institute observations and enquiries in the wide field of nature, spread out before them on all sides, and inviting their attention.—*Editor.*

Fig.1.

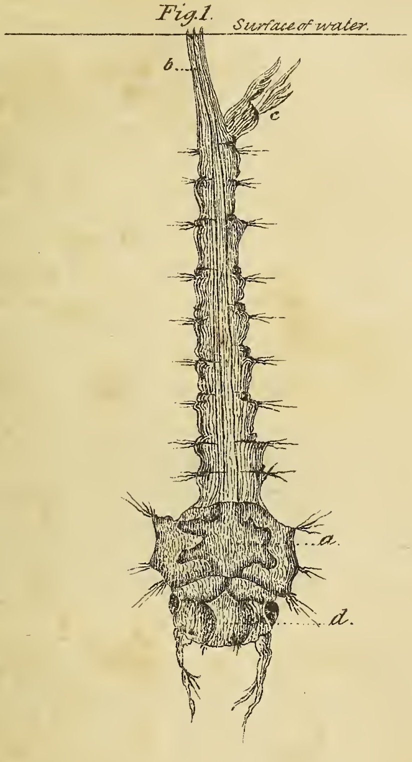

Fig. 2.

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nquiries in the
des, and inviting their attention.—*Editor.*

culæ immediate exit from the shell into the water; and the concavity of the whole collection, above alluded to, effectually tends to retain the large ends undermost. Had the ova been arranged promiscuously, as to the large and small ends being upwards and downwards, it is evident that the newly hatched insect, under the former arrangement, would have some difficulty in reaching the water, a difficulty that, most probably, would amount to an impossibility; one which, at all events, is effectually prevented by the concave form of the collection.

A sketch of the newly hatched insect, about 2,500 times the natural size, is given in figure 1. In the chest, or thorax (*a*), the heart is seen (obscurely however, the body being only semi-transparent), furnished with four projections; from this organ two blood-vessels proceed down the centre of the body, to the end of the elongation (*b*), the extreme termination of which is to be seen just above the surface of the water, where the insect lives, for the most part; the body being suspended, as it were, from this, head lowermost.

Between the heart, in the thorax, and the extremity of this singular elongation, an active sanguiferous circulation is to be observed; in all probability, therefore, it is the seat of the lungs or gills, and it would appear, that a comparatively large supply of air, is essential to the existence of the insect, as it lives, as much as possible, in this pendulous position at the surface, with the extremity of the elongation rising just above.

Its motion, which is quick, is effected by a rapid bending of its whole body, so that head and tail (the latter represented at *c*), and consisting of a bundle of delicate filaments, approximate, alternately, on either side of the body; it always goes tail foremost, so that the head is dragged along behind. When in search of food, it throws out, in advance of its mouth, a couple of delicate brushes, the individual filaments of which, though seen magnified to the extent above stated, were still of microscopic size. The oval shaped figures in the head (*d*. fig. 1.) represents these brushes when not in use (though obscurely, as the semi-transparent body intervenes). Each of these is put in rapid circular motion, whereby a double kind of whirlpool is occasioned; whatever food comes within the sphere of these vortices, is speedily devoured. The food appears to be, principally, decomposing vegetable matter, some of which I put into the tumbler, as the vessel in which the ova were discovered contained it; on this they fed voraciously. They did not, however, entirely confine themselves to a vegetable diet. I was much amused with one, when in a drop of water under the microscope; in these confined limits its appetite did not forsake it, and the only article of food it found, was the head of one of its own species. So soon as this came within the vortex, it was ravenously seized, but, being, apparently, too large a *morceau*, it was let go, after sundry futile attempts at swallowing. It frequently came within the

whirlpool again, and was as often seized, but with no better success. They, however, eat the shells they had recently quitted. Some that were kept in clean water, without food, died on the third day. In this stage of their existence, the insects were lively and grew apace.

At the termination of 21 days, during which the water was thrice changed, they had attained three or four twentieths of an inch in length. On attaining this size, or age, they underwent a second metamorphosis. The shape they assumed is represented in figure 2, magnified, like the former, 2,500 times. Most likely they cast their former envelope, for the hairs, so conspicuous on the former insect, were not to be seen on the present. The shape, it will be remarked, has materially altered, but the most remarkable change is that which occurs with respect to the seat of the lungs, or gills. These organs are now situate in the thorax, their former seat (the elongation b. fig. 1) has disappeared, and the channel of communication, now, between them and the air, are two small tubes (b. fig. 2) on the top of the chest. In this stage of their existence, the insects are much less active than during the former one. A still greater contrast, however, is that, now, they do not require food, and have no mouth; in this respect resembling the chrysalis stage of the butterfly tribe. But the demand for air appears increased; they rarely leave the surface of the water, and, when they do descend, they take down a supply of air, small globules of which are distinctly to be observed, at the end of the tube (b. fig. 2). Their descent is accomplished by striking the water with their body, but, being specifically lighter than that fluid, they rise without any effort to the surface, though, in case of *despatch*, can impel themselves upwards by the same means as they descended. However, as has been remarked, they seldom leave the surface, and, having done so, speedily return to it.

The insects remain about 48 hours in this stage; towards the termination of which the legs aud proboscis of the winged musquito can be distinctly seen through the thin membrane that surrounds it. This, in due course, bursts, when the winged musquito draws itself out, stands on the surface of the water a few minutes, to dry and expand its wings, on which it presently proceeds to a dry situation. I observed several undergoing this change.

If the musquito, when in either of the first two stages, be taken out of the water, it speedily dies, and it is as speedily deprived of life, if immersed in that fluid immediately after becoming the winged insect.

We learn from the above, that the musquito is a most prolific insect and that, as stagnant water such as that of tanks, &c. is necessary to its propagation, all such ought to be kept as distant as possible from our dwellings; thereby we are more likely to enjoy an immunity from their annoyance, than by practising the mode so facetiously described, or rather suggested, by Captain Basil Hall in his voyages.

XII.—*On the Mass of the Planet Jupiter.—By* Goday Venkata Juggarow.

I believe I shall not be quite mistaken, if I affirm that, till very lately, the science of Mathematics was but little studied, if not unknown altogether, among my countrymen. The air of mystery with which it has been invested by those who, while they admire, shrink from a nearer approach to it, has succeeded in keeping many of my timid brethren at a respectful distance, in the outer court of the temple. With a view to encourage the beginner, and persuade those more advanced of the possibility of comprehending a great deal, with a moderate quantity of knowledge only, I shall, from the observations which have been made for the purpose, and without any great mathematical display, proceed to weigh the planet Jupiter. This may appear a bold and presumptuous step, but the computation which follows will I hope, leave no doubt of its practicability.

The weight of a body is found to vary, according to the circumstance of its situation—thus, upon the top of a mountain, a body is found to weigh less than on the plain below; and, at the distance of the moon, the weight of a body would be found reduced to 1-3600 of its weight at the surface of the earth—a fact which is immediately arrived at from the law, " that the force of gravity varies inversely as the square of the distance."

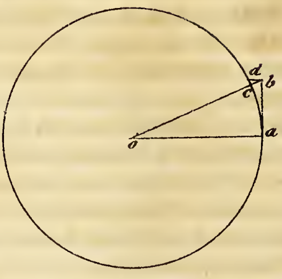
In the case of the planet Jupiter, and, indeed, of all the other planets, they are each kept in their orbit, by the attraction of gravity, being proportional to the centrifugal force in the orbit. Hence the distance of any body from the sun, varies with the time of its revolution round the sun, and may be determined from the Keplerian law, " that the square of the periodical time varies as the cube of the mean distance."

With these two laws, which it only requires common sense to render obvious, and the further consideration that the force of gravity varies as the mass of the attracting body, we will now set to work.

From the Cambridge observations for 1834, we find that when Jupiter's fourth satellite was at its greatest distance from the planet, as seen from the earth, it subtended an angle of 10′ 45″ 9. From the Nautical Almanac we find the logarithm of the distance of Jupiter from the earth $= 0, 6488251 = D$. Hence we find, the distance from Jupiter at which his fourth satellite revolves, as follows—as rad : D : : *sin* 10′ 45″ 9 : $d =$,012055 (the earth's distance from the sun being 1). Now the time occupied by this satellite to revolve round Jupiter, is 16*d*. 16*h*. 32*m*. 8*s*. or 1441923 seconds, or, in one second of time, it performs in its orbit 0″, 89 88.

Let the subjoined figure represent the orbit of Jupiter's fourth satellite; *a* being its situation at one moment, and *c* its position at

the expiration of one second. On decomposing the motion *a c*, it evidently results from the centrifugal force *a b*, and the force of gravity *d b*;—*d b* being the sagitta to the curve, or the versed sine of 1″, to the radius *a o*, or *d*, as found above. If we comp ute *d b* from the expression *ver. sin* $\theta = 2 \sin^2 \frac{\theta}{2}$ it comes out ,00000000000951 = 4,77 feet; that is to say the fourth satellite, by reason of the attraction of Jupiter, gravitates towards him at the rate of 4,77 feet in one second of time.



Were the mass of Jupiter one hundred times greater than it really is, it is plain that he would attract his fourth satellite with one hundred times the force; and, consequently, produce one hundred times greater velocity than the above, &c. &c. Let us now see, if Jupiter's fourth satellite were placed at the same distance from the sun, as it is found to be from Jupiter, what would be the force of gravity exercised upon it by the sun. By the second law stated above, we have as $1^3 : \overline{,012055}^3 :: \overline{365,25}^2 : t^2$ the square of the time, which would be occupied by a body to revolve round the sun at this distance. ∴ $t = 42031{,}9$ seconds; hence, in one second of time, the body thus placed would perform 30″, 834; and, decomposing this, we find the gravitating force, or the versed sine of the angle, to be ,00000001117000, or 5600, 93 feet; that is to say, the planet Jupiter's force of attraction, is to the sun's force of attraction, or the mass of Jupiter to the mass of the sun, as 4,77 :: 5600, 93 or as 1 : 1174, 2 *i. e.* the mass of Jupiter is $\frac{1}{1174,2}$ of the mass of the sun. This result would be a correct one, were it not that whilst the secondary is gravitating towards Jupiter; *he*, (in proportion to his mass) is gravitating towards his satellites; but the neglect of this will affect the above by a very small amount, whereas its introduction here, would tend much to lengthen this communication, and to make it unintelligible.

If we now assume the mass of the earth to be $\frac{1}{354936}$ of the sun, as has been found in a manner similar to the above, the mass of Jupiter = 302 times that of the earth, and since the earth's weight can easily be computed, it is evident we as easily obtain the weight of the planet Jupiter.

*** We have introduced the foregoing into our Journal, not because we suppose it will inform the scientific Astronomer of any thing he was

unacquainted with before, but because it may interest the general reader to see how this great theorem in physical Astronomy is worked out, and, further, we submit it to our readers as a *literary curiosity*, being the production of a native of India, among whose brethren intellectual efforts of such character are too uncommon, to permit us to pass by the present one, regardless of such a phenomenon.

Goday Vencata Juggarow is the son of M. Ry. Goday Soorea Narrain Row, who, with his brother Pracasa Row, hold extensive Zemindaries, under the British government, at Vizagapatam, and are well known, to all residents in that neighbourhood, for their great intelligence and public spirit, and for the munificence with which they support the character of native gentlemen.

Goday Vencata Juggarow is a worthy son of his excellent sire; and promises to be a distinguished instrument in the good work of elevating the people of India from the character for indifference to intellectual acquirements, too justly chargeable on them, we are sorry to say, and on those of the Peninsula more especially. Two years ago, from an innate desire of knowledge, he was induced to place himself under the tuition of Mr. Taylor, of the Madras Observatory. At that time he was only acquainted with the first principles of Arithmetic, and now, at the age of 19, we have Mr. Taylor's authority for saying, he is qualified to pass a first class examination in Mathematics in any College in Europe. His knowledge of the English language, also, is highly creditable, and his acquirements, generally, would not disparage the character of a well educated man in England.

We say these things, not to gratify his vanity, if that foible lurks in his bosom, for we hope that he is so far advanced in knowledge as to have become *humble;* (to use the words of a master-spirit of our age) "seeing that all the longest life and most vigorous intellect can give him power to discover by his own research, or time to know by availing himself of that of others, serves only to place him on the very frontier of knowledge, and afford a distant glimpse of boundless realms beyond, where no human thought has penetrated."* We have entered on these remarks with the hope of stimulating him to continued labour in the acquisition of knowledge, and to point out that, as Providence has blessed him with excellent talents, and has placed him in a station of life where his example will have great influence, it is his bounden duty to do all in his power for the promotion of education among his countrymen, with the view of elevating them as a people in the moral and intellectual scale. We hope, too, that his laudable example, will induce others of our native fellow subjects to explore the pleasant paths of European science and literature, and to send their children where a knowledge of them may be acquired.—Editor.

* Sir J. Herschel's *Discourse on the Study of Natural Philosophy*, p. 6.

XIII.—*A Visit to Cumbaucum-droog, a remarkable Table Land near Madras.—By Colonel* MONTEITH, K. L. S., *of the Madras Engineers.*

The following account of an excursion to the range, or rather cluster, of hills called Cumbaucum-droog, a ridge connected with the well known Nagary hills*, perhaps will interest the readers of the *Madras Journal of Science and Literature*, as their jagged outlines and blue summits, are daily before our eyes, but are rarely, if ever, visited; indeed, they may be said to be totally unknown to the inhabitants of Madras. A very correct survey, it is true, has been made, and charts of most of the principal mountains are to be found in the Surveyor General's Office, but nothing that I am aware of, has ever been before the public, on a subject of no small interest to the inhabitants of this great city, who seek that change of climate and cool weather at a distance, which they may command at their own doors.

For a long time I had determined on visiting these hills, but one cause or other delayed it till January 1834.

I followed the road of the Red Hills (which is rather out of the

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* These hills, which seem to be ridges diverging from the eastern ghauts, are known in various localities by the names of the places situated near them, thus we have the *Tripetti* hills, *Nagari* hills, *Calastri* hills, *Ramgherry-droog*, *Cumbaucum-droog*, and many others. We learn, also, from Lieut.Garling's Memoir, that the latter place was called *Kullied-droog*, from the village of *Kullied*, when it belonged to the Calastri Rajah. The following is extracted from a Memoir on the survey of this part of the country by Lieutenant Garling, dated 1810. —*Editor.*

" About this part of the country, the ghauts spread to the eastward, and form a deep mass of immense mountains. In this particular part, a broad valley penetrates amongst these mountains, and is continued by two large breaks to the table land of the Ceded Districts—the Hills, on the southern side of the valley, extending themselves to the eastward along the middle of this tract, with but little general diminution of height, to within 26 miles of the coast, when they have a sudden fall, and spread out by lower hills and slopes to the edge of the Pulicat lake. These hills divide the country into two parts, the southern of which is a highly cultivated valley, through which flows the Narnaveran and Corteliar rivers; the northern part is a plain of very great extent. The hills on the north side of the valley before mentioned, do not proceed far to the east, before they turn off to the N. W. bounding the plain by a steep wall; the general height of these hills varies from 2 to 3000 feet above the level of the sea."

direct line), as it admits of so much of the journey being performed in a carriage ; and from that spot rode to the banks of the Corteliar. With the exception of a very short distance at the end of the made road, the remainder is natural, and, if once formed into a regular road, would remain in good order with very little care, from the nature of the soil it passes over, and would require few or no drains, or other artificial aids. It is singular no bridges should ever have been constructed, or, I believe, even proposed, for this river, which offers far greater impediments than the Adyar, and from the difficulties I experienced, and from the fact of carts being often overturned in the water, to the ruin of their loads, this deficiency loudly calls for attention. It would be well if our views were directed, in the first instance, to the indispensible necessity of rendering the country generally practicable, along the great thorough-fares, by boats, bridges and passable routes (now far from the case), rather than to provide the higher conveniences, such as rail roads, &c. near Madras, to the utter neglect of the remainder of the country.

From the banks of the river, which are generally low, with a fine soil, the jungle is rapidly advancing ; and we again ascended the red gravel hills, and found it difficult for even a palankeen to pass through the thick bushes, which will soon surround *Sittavadoo*, a once considerable town, and possessing a stone fort of solid construction, and in a good state of preservation. It has never recovered from the effects of the cholera and fever, which, for some years, desolated the Carnatic ; but the present inhabitants speak favourably, of the general healthiness of the climate (a fact which I have heard disputed). The position possesses all the natural advantages of elevation, dryness and good water. This part of the country appeared to me to be in a rapid state of decay.

Game is abundant, and the sportsman would be amply repaid by a visit of a few days. Elk, deer, hog, hares and partridges, were plentiful at about three miles distance. The hill fort of Cumbaucum was distinctly visible, and appeared so close that I expected a short ride, only, thither. The road, however, though naturally good, had very recently been much encroached on by the jungle, which is a melancholy fact, generally, in this quarter. And this to be the case so near the southern Capital of India !

The high ground, extending for several miles, appears to be a continuation of the same formation as the Red Hills. The route then led through a fine valley of rich soil, with some little cultivation, but gives evidence of a once more considerable population ; many tanks still held water, and the marks of fields and villages were distinct.

It struck me this formed an excellent situation, for trying the Belgian system of locating paupers, and relieving Madras from the number of

mendicants which infest its streets. The Friend in Need Society, if they obtained a grant in this direction, might much enlarge the sphere of their relief, applying the profits to a still further extension of the same principle. Discharged and pensioned soldiers, would, I think, also gladly accept grants, and again restore these districts to what they once appear to have been.

On arriving at Cumbaucum, about three miles from the mountain, the village could furnish no supplies, and I contiuued my journey to the first village in the Calastri Rajah's territories (*Teliarverdi-pett*), where there was, certainly, a great change for the better, in the general appearance of the country.

The village was large, with good houses, a fine choultry, and a number of excellent horses, said to have been bred here, which may be the case, as grass appeared, in great abundance, in every direction. My baggage did not arrive till 9 at night, having got entangled in the jungle, and lost the road, which is only sufficient to allow a bandy to pass.

The arrangements were soon made for ascending the mountain, which, certainly, presented rather a formidable aspect; and the difficulties were not a little exaggerated by the people. It was agreed to start an hour before day, as we might have a chance of getting a shot at elk, or other deer, which were said to come into the cultivation at night. This proved to be the case, for four very large animals were seen within two miles, and, as one was supposed to be wounded, a party was left to find it, but without success. Smaller game appeared in abundance, and a few hogs; but they were distant, and the country so stony, that the chace was soon abandoned.

The ride was beautiful, and we constantly crossed streams of water, which appear, at certain seasons, to be of great magnitude; but, from their present clear limpid waters, must, I presume, come from springs, and never be altogether dry. The jungle had many fine trees, mixed with bamboo, and occasionally good grass-land of considerable extent. Red wood abounds here, and many carts from Madras were collecting it. Though the Pulicat lake is only ten miles distant, some obstacle exists as to transport by that channel and the canal. They, therefore, prefer going direct to Madras; so other woods, fit for building, &c. would not pay the expense of transport.

In the bed of the river, I also remarked limestone, of a good quality, and several villages in the neighbourhood, manufacture iron, from ore which they collect on the hills, yielding about 50 per cent. The furnace was of a very simple formation, and like a large crucible of the best modern shape. I did not see the process, but the whole expense of these iron works, for furnace, machinery and buildings, could not exceed three rupees.

At the third mile from our tents, the ascent began near the north extremity of the mountain, and at one time appears to have been defended by a lower entrenchment. I turned off to look at a gun, said to be of great antiquity. It proved to be an English six-pounder of iron, and it still might be used, and was probably abandoned in the jungle, when we made a demonstration of attacking this fort, during the Poligar war.

There would have been no difficulty, in riding half a mile further than where we had left our horses. The jungle then became dense, with a very tolerable foot-path, though steep and rough, from the water which appears to make this a channel during rains. There is no obstacle to cutting both a broad and easy road, and it is said one for carriages formerly existed. The ascent occupied an hour; when we reached the outer entrenchment, or gate, about 1,800 feet above the sea. The second line is about 1,950 feet, and much more considerable; formed of huge blocks of roughly hewnstone, and about ten feet high. This, though the best, is not the only, road ; and, masked as the works are by passable jungle, the fort is stronger in appearance than reality.

On passing the second gate, the ground becomes perfectly level. Near the outer edge of the rock, the soil has been partly wasted away by the rain, being hard compact sand, covered with high grass, and some trees ; among the latter some good sized red wood.

The soil gradually improves as you advance, and, near the ruins of the old palace and garden, is of the richest description. An enclosure, and a few traces of foundations, are all that now mark the spot, which is said, not very long since, to have produced the best fruit in the Carnatic, particularly oranges. A flight of stone steps lead to an extensive reservoir of water, which might, at a trifling expense, be repaired ; and a little water, I am told, always runs in the ravine, and no want of that necessary element is ever experienced.

The fine level ground, occupying the N. end of this table mountain consists of about two square miles, and, as nearly as I could make out, is generally 2,000 feet in height. To the south extremity the soil is more rocky, and rises to an elevation of 2,550 feet, correctly ascertained in the Trigonometrical survey.

The summit is nearly free from jungle, and there is little or no swamp; what there is, could be drained by ten men in a single day. There is enough timber for building and fire-wood; the sides of the mountain afford an inexhaustible supply. The stone is good for building, and lime, in abundance, is found at the foot, and most probably on the top, of the hill. Standing as this does within ten miles of the lake, and about fifteen of the sea, it enjoys the fresh breezes we so much prize at Madras, and is totally free from hot winds.

The people did not consider it unhealthy, and had abandoned it in consequence of some people having been cut off by robbers, who paid this retired spot a visit within the last twenty years. There is no reason why it should be feverish ; but that is a point only to be ascertained by experience. The thermometer stood at 65° at noon on the 26th January, and the water in the old reservoir, which is very deep and well shaded, at 62°. This is 12° below that of the plain. Abundance of rain is said to fall, which I think very probable, from the clouds and thunder storms we constantly see arrested there, when they are so anxiously expected in the low country. Its vicinity to Madras (being only one night's run in a palankeen), its elevation, and the beauty of the prospect, point it out as a most desirable retreat in the hot weather, or for those who stand in need of a change of climate, and whose business may prevent their going so far as Bangalore.

A garden of the best description might also here be cultivated, and the distance is not so great, as to prevent the produce being sent in to Madras. We should thus enjoy all the luxuries for which Bangalore is so much extolled. The road is naturally excellent, and only requires to be cleared of a few low bushes, as far as the foot of the mountain; and one of three miles, along the slope of the hill, would make the remainder far more easy than any of the ghauts I have ascended.

The road should be continued along the range of the Red Hills, which extend nearly the whole distance, giving, on the spot, material of the best kind for the construction of roads; and with one or two bridges over the Corteliar, and another river, would afford a perfect carriage road, and be of incalculable advantage to the country generally. For baggage, if water carriage is preferred, the lake can take it as far as Soolurpett, distant from the foot of the mountain eleven miles.

Yenga Abasaney, a Poligar chief, is said to have first established himself on the mountain; it, subsequently, fell into the hands of the Nabob of the Carnatic, who built a palace, and frequently resided here, to enjoy its fine air and prospect. The garden was cultured to within a very recent period; the wild hogs have, however, destroyed whatever there may have been, and no fruit trees are now visible.

XIV.—*On the Language of the* Battas *of* Sumatra, *by Lieutenant* T. J. Newbold; *with Remarks on its Hindu affinities, &c., by the Rev.* W. Taylor.

Bellary, *May* 31*st*, 1836.

Sir,—I have the pleasure to present to the Society an alphabet of the *Battas* of Sumatra, with a specimen of their writing, recently received from the Straits; also a copy of a code of *Bugis*' maritime laws, with a translation and vocabulary, and alphabet in the *Bugis* character.

Mr. Marsden has published an alphabet of the singular language of the *Battas*, in his history of Sumatra: but, as this differs somewhat from the one now sent, not only in the arrangement of the letters, but in its being written from the left to right, instead of from bottom to top, (a circumstance which Dr. Leyden, in his dissertation on the languages and literature of the *Indo-Chinese* nations, takes notice of in the following words—"Marsden has given a tolerably correct *Batta* alphabet, in his History of *Sumatra*, but instead of placing the characters in a perpendicular line, he has arranged them horizontally, which conveys an erroneous idea of their natural form;") I have deemed it worthy of notice, particularly as so little is known respecting the literature of this singular family of mankind, a subject to which I would fain urge the attention of those who have leisure and opportunity. The authors I shall have occasion to quote, have hitherto afforded us accounts but little satisfactory on this point, indeed scarcely more than to excite attention and curiosity.

The Alphabet of the *Battas* consists of nineteen letters, which in power resemble those of the *Lámpúngs*, the *Búgis* and the *Javans*. According to Mr. Marsden (as previously alluded to), the character is written from left to right; and, according to Dr. Leyden, from the bottom to top. Mr. Anderson, however, in his mission to Sumatra, asserts, that both authors are correct, from the circumstances of a *Karau-karau Batta* having written, in his presence, from left to right, upon paper with a pen; and the great cannibal rajah of *Munto Panei* having inscribed, upon a joint of bamboo, with a knife, from bottom to top.

From what I have heard from *Battas* who have migrated, and from the specimens of their writing which have reached me, I should incline to the opinion of Dr. Leyden, that the Batta characters are written, generally, in a manner directly opposite to those of the Chinese, from bottom to top. They bear some analogy to the *Tagála*, or *Philippine*, characters. The language is supposed to be one of the most ancient in Sumatra, and, if we may credit the *Battas* themselves, it forms the basis of all other languages prevalent in that vast island. The *Rejáng* and *Lampúng* dialects are certainly formed upon it; and, according to Dr. Leyden, it is connected with the *Búgis* and *Bíma* languages, as

well as with the Malay tongue, the *lingua franca* of the Indian Archipelago. The Batta language itself has several dialects; specimens of those of the *Karau-karau* and *Perdimbanan* tribes, are afforded by Mr. Anderson in his mission to Sumatra. Of their books we have little or no account; Leyden, with all his research, was unable to procure more than the names, merely, of the following, viz.

1. *Siva Marangaja,* 3. *Raja Ssiri,*
2. *Siva Jarang Mundopa,* 4. *Malamdeva.*

Raffles mentions the subjoined, as books of which the names and contents, were furnished him, by a chief named *Rajah Bandára.*

1. *Dha'un ;* on medicine.
2. *Pelú on Balangkahan Malay ;* on Astrology.
3. *Tandong ;* on the art of war.
4. *Rumba ;* on ditto.—This is referred to in cases of the last extremity.
5. *Pangram Bui :* Rules for taking up proper positions, &c. in war.

With regard to the *Battas* themselves, Sir Stamford Raffles appears to have been misinformed, when he describes them as being *one* extensive nation; the fact is, they are a collection of tribes, under as many chiefs, inhabiting, principally, the interior of that part of Sumatra, which lies between *Achin* and the now decayed empire of *Menang cábowe.*

Sir Stamford states these to have a regular government, written codes of laws, a religion peculiar to themselves; acknowledging the one, and only, great God, and a trinity of deities created by him. They also believe in an evil deity, and a spiritual existence after death. Their population is estimated between one and two millions.

Serious, and some improbable, charges of cannibalism have been brought against them by Beaulieu, Marsden, Leyden, Raffles, Anderson, Burton and Ward*; but all agree in pronouncing them to be a warlike, independent, and generally intelligent race of men. Authentic information touching their literature, language, state of civilization, laws, religion, manners and customs, still remains a great desideratum in the history of Eastern Asia—a *hiatus* which it is to be hoped will be ere long filled up, by our Dutch neighbours in the straits, who are now actively engaged in attempts to subjugate that part of Sumatra.

I have the honor to be, &c.

To the Secretary (Signed) T. J. Newbold.
Asiatic Department, Madras Literary Society.

* This question is set at rest by the conclusive evidence adduced by Captain Low in his account of the Batta Race in Sumatra, contained in the third No. of the *Journal of the Royal Asiatic Society*, where the fact of their cannibal propensities is stated, on sufficient authority, to have been testified by several chiefs of that people.—*Editor.*

*** The above letter, and the alphabet and written characters to which they refer, we submitted to the Rev. W. Taylor, the learned Translator of the *Oriental Historical Manuscripts*, and they have elicited from him some highly ingenious and recondite remarks, which we have great pleasure in appending to Captain Newbold's letter. We hope that the two together, will be sufficient to promote enquiry into a subject which promises to be prolific of interest in philology, history and antiquities.*

" 1. The characters of the alphabet and inscription have no resemblance to any known character, at any time used by Hindus ; but, on referring to the copies of inscriptions, in an unknown character, in the 7th vol. of the Asiatic Researches, as copied from the so-called *Lât* of *Firoz Shah* at Delhi, I found two of the characters there, and subsequent minute examination convinces me, that there are several other characters closely similar, if not the same, in the two series of documents. There is always a degree of uncertainty regarding perfect accuracy in representations of inscriptions copied, but not understood ; and some allowance may, perhaps, be here made with reference to both of these authorities.

" 2. The titles of the four books, mentioned by Dr. Leyden, struck me at once as very plainly of *Sanscrit*, or *Pracrit*, origin. The other books, also, Nos. 3 and 4, in their titles closely resemble *Tamil* words of similar signification.

" 3. I was hence led to conjecture that, perhaps, the *Battas* may be descendants of *Buttas* or *Baudhists*, who were, several centuries ago, driven from continental, and especially from peninsular, India, by Braminical persecution. In a Tamil manuscript, given in the appendix (p. 43) to the *Oriental Historical Manuscripts*, it is said that a female of that race, having escaped from that persecution, afterwards gave a succession of kings to Ceylon. If a female escaped, many men might have done so, and they may have gone further east than Ceylon. Professor Wilson, in the preface to his Sanscrit dictionary, p. xx, says : " In 530 the religion of *Buddah* was introduced into Corea in 540-50 into Japan, and the year 572 was remarkable for the arrival, in that kingdom, of an immense number of priests and idols, who came from countries beyond the sea :" a passage standing in connexion with enquiries and details regarding the Braminical persecution of the Bauddhists. The inference seems to me, at least, very possible, that if Bauddhists came by sea to Japan, they would reach intermediate islands, inclusive of Sumatra. It is a singular fact, that, to the present day, at Madura, Ceylon is called *Yapal-divu*, meaning, as I conceive, the *island Japan*. And, since we have clear and authentic records con-

* We wished to give a lithographed *fac-simile* of the alphabet and characters, but the number of illustrations already prepared, we are sorry to say, prevents our doing so.—*Editor.*

firmed by an annual celebration, down to the present time, of the persecution and impalement of the *Bauddhas* at Madura, it is likely that those who fled from persecution, purposing to go to *Yapal-divu*, would not, all of them, halt by the way, until they had found an island, corresponding in name with the object of their search.

" 4. Some little difficulty is interposed from the rather ill-defined distinction between the *Bauddhas* and *Jainas*. However, in manuscripts bearing on the records of the ancient kingdom of Madura, I find the *Samunar* and *Buttar*, or *Boodur*, (the letter *r* being the plural termination in high Tamil) spoken of synonimously, that is, the terms are interchanged, still referring to the same people. I consider, therefore, that any distinction, or sub-division, of them, is unimportant to the present purpose.

" 5. Looking now at the titles of the four books, mentioned by Leyden, the first of them, *Siva Marangaja*, probably refers to the well known *Hindu* fable of *Siva* destroying the Hindu *Câma*, by opening his frontlet eye, and burning his assailant to ashes. *Màra* is another *Sanscrit* name for *Manmatha*; and *gaja* is Sanscrit for an *elephant*. It is, however, probable, and sanctioned by many analogies, that *dh* has been changed, dialectically, into *j*, and *c* into *g*; and, then, *Siva Maran cadha*, would mean the *tale of Siva and Manmatha*, possibly some *Batta* version of that fable. The second, *Siva Jarang Mundapa*, also seems to be *Sanscrit*. *Siva Sarang* may be rendered, *any thing pertaining to Siva*, as his sect, or the like; *mandapa* is a choultry, or open porch, fronting a temple; hence the meaning may be, *the porch of the votaries of Siva*, and may have reference to dogmas, or actions, of that class of Hindus. The third, *Rajah isiri*, is an every day title; natives address respectable persons with the title of *Maha-raja-raja-sri*, and the insertion of the vowels, as *isiri* for *Sri*, is colloquially common likewise. As the title of a book something must be wanting, seeing that *Raja-sri* is a prefix to some following name. The fourth, *Malamdeva*, apparently denotes *Vishnu*. *Mal* is one of Vishnu's names; *âm* (in Tamil) signifies being, or *one who is*, and *deva, a god*, that is, *the god Vishnu*. Again, in the other books, *Tandong* is apparently the same word with the Tamil *Tandam*, an army, and *Rumba*, denotes a sword, or saw. *Pangram* appears to be derived from the Sanscrit *Sangrama*, any matter pertaining to war. These resemblances indicate, I think, a derivation through the *Pali*, the sacred language of the *Bauddhas*, itself a dialect of the *Sanscrit*, or a *Pracrit*, and having many ascertained resemblances to the *Tamil* language; which last, however, if considered in its substratum, is not a derivative from the Sanscrit.

" 6. Comparing the *Batta* alphabet with the *Batta* inscription, I observe that the letters in each seem turned different ways, and the alphabet does not assist as to vowel points, or other diacritical marks. Perhaps, with the assistance of Mr. Marsden's alphabet, the sounds

derivable from the inscription might be made out; but I have not full leisure for the process at present. As far as I have tried, and with a few sounds only, it seems to be a soft language, but without affinity, as far as I can yet discover, to any Hindu language; but on this point I would use some reserve.

"7. On looking through Mr. Marsden's work on Sumatra, the great frequency of purely Hindu words struck me forcibly. Not only are these words *Indian*, but many evidently *Tamil*, and that, too, of the kind spoken in the southern extremity of the Peninsula; names of mountains, fruits, &c. &c. are of Hindu origin; and in the officers of the King's Court at *Menang-cabowe*, I note the precise system of aboriginal Native Courts, the *Mantri*, or chief minister, having the same title in both cases, and, in other three instances, the office is the same, the names being varied. It may be observed, that these coincidences are most distinct in Mr. Marsden's account of the *Réjangs*, concerning whom he is most full, as he but superficially notices the *Battas;* so that as to them they are less distinct. The feudal government of the *Battas* by chiefs, having a nominal respect or allegiance to Menang-cabowe is, however, an Indian feature. To detail the whole of the resemblances and coincidences, derivable from Mr. Marsden's work alone, would require an essay; and cannot be attempted in this brief notice.

"8. Adverting now to the word *Battas*, it appears, that it is properly *Battak:* the question, whether this difference occasions any difficulty, arises; and it seems to vanish at once, when we remember, that the low *Tamil* plural is formed by *kal*, so that *Buttar* and *Buttakal* both are plural, and differ only dialectically. But, again, there are various uses of the same word, or similar words. *Batta* denotes the goldsmith's tribe. *Bhatt* (vulgarly *Butt*) is the distinctive name of a class of Bramins in the north; and in the south the same class bear the distinctive title of *Pattar*. *Buttar* denotes, as aforesaid, the *Bauddhas*. Etymological conclusions, by consequence, cannot be certain. If the inscriptions, in the singular building (of Hindu origin) at Delhi, could be deciphered, I think light would be thrown on this question.

"9. Referring to Raffles' History of Java (which I had not previously read), all uncertainty as to Hindu relations with that island is dissipated, by the strongest assurance. Either the *Yavanas*, as celebrated, as they are obscure, in the annals of this Peninsula, must have come from Java to India, or else they must have proceeded from India to Java; the former is not probable, and the Javanese trace their origin to India. With antique *Deva-nagari* inscriptions; with other inscriptions, resembling what is in this country considered to be *Hala Canada;* with Hindu buildings; with Hindu tales and genealogies; they must have had a relation with India. It is simply impossible, that the case could be otherwise. For instance, *Brata-Yudha*, the title of the Javanese version of the *Mahabharata*, is quite Tamil.

Yudha, in the high dialect, is commonly used for *war*, and *Baratham* is the familiar name of the same epic poem or romance. The Javanese inscriptions, in one or two instances, more resemble the inscription at Allahabad (also given in the 7th vol. of the Asiatic Researches) than those at Delhi; but, besides this circumstance, others have Tamil letters, and, in the Javanese alphabet, some bearing the same name and power as the Tamil, and others of the same form, but differing in power; and, as the analogy seems still closer to the *Grandam* letters, the character in which Sanscrit is usually written in the Peninsula, and the matrix of the Tamil letters, I infer that they *may* be derived from the *Grandam*. Other characters resemble the *Telugu* letters, and others, as before said, the *Hala Canada*. Now Mr. Wilkins informs us, in his grammar of Sanscrit, that many provincial alphabets, less perfect than *Deva-nagari*, exist. The Tamil, I am clearly certain, is formed on the model of the *Grandam*. The *Telugu* indicates a different matrix. The *Hala Canada* differs still. But, as Javanese inscriptions and alphabets partake of the *Deva-nagari*, the *Hala Canada*, the *Grandam*, the *Telugu* and the *Tamil* forms, is it not at least possible, that, at a remote period, the Javanese alphabet was shaped, or selected, out of all these? Unless, indeed, it be a primitive and earlier character than any other of them, and a parent, rather than a derivative. There are ancient inscriptions, in different parts of the Peninsula, which pass for *Hala Canada* ; but are not entirely resolvable by such specimens of the character as have been deciphered. May the Javanese character by any possibility give an additional clue ? On this point conjecture only can be offered. But I do think it extremely likely that Javanese antiquities will reflect light on obscure Hindu traditions, writings or inscriptions, and receive illustration in return.

" Sir S. Raffles expressly says, that, while the *people* of the Javans are of Tartar origin, their chiefs differ, and resemble more the Hindus; and by Hindu emigrants, very probably, the country was, at some time, subjugated. The *Yavanas* are almost as familiar to Hindu records, as the *Bramins*, the *Bauddhas*, or any other tribe.

" 10. Finally, referring to Anderson's Mission to the east coast of Sumatra, I may observe that his narrative confirms the preceding deductions. His mission was properly commercial; he saw but little of those *Battas* who reside nearer to the west coast; and besides, being apparently a young man, he evidently had little taste for history and antiquities. The cannibalism of the *Battas*, seemed to be his chief point of enquiry. This most depraved and disgusting feature in their character, is strongly repulsive; but it may be separated from enquiries as to their origin. He saw only some straggling traders, and one petty rajah (a sort of Zemindar), of that class, and intimates that the Malays considered it to be a miracle that he escaped without being eaten. Notwithstanding these things, there are, scattered through his book, vestiges of Hindu relations in the ancient people of Sumatra,

though much disguised by the more recent prevalence of Mohamedanism. To gather the whole together, would be properly the work of one part of an essay, such as before alluded to. Omitting many other deductions from names, the following in Mr. Anderson's list of Batta states (pp. 225-26) may be specified; that is to say, *Purba*, *Mahriat*, *Naga-saribe*, *Nagore*, *Singa*, *Perdumbanam*, *Dorma-Rajah* : these are Hindu names, slightly modified. In an account of a survey, by Lieut. Crooke, of the *Jambi* country and river, the name *Jambi* strikes one as apparently derived from the Hindu *Jambu-dwipa*, and it contains the mountain *Indragiri*, a purely Sanscrit name, meaning the *mountain* of *Indra*, regent of the atmosphere. But, I allude to the survey chiefly because it states that, at the town of *Jambi*, were found statues of great antiquity, and to me most evidently of Hindu characters. Two of these seem to have been *Buddha*, or *Jaina*, images, specifically so in the case of one with features broad and flat, hair curly, in little round knobs, and formed into a top knot. Four other figures are those, unquestionably, of *Ganesa*; another of *Nandi*, the bullock vehicle of *Siva*; and, moreover, the ruins of an ancient temple are spoken of, the images and sculptures of which the natives now term "chessmen of the giants, or genii."

"I will merely add the singular name of a queen, or princess, mentioned by Mr. Anderson in the early part of his book; this is *Rajah Wan Chandri Devi*. *Wan* seems to be a modern Sumatran, or Malayan, title; the other three names are Hindu, only one of which, *Devi* (goddess*) could, with grammatical propriety, be applied to a female, for *Rajah* and *Chandra* are both masculine epithets, according to Hindus; yet we find the termination of one of them modified to *Chandri*, a feminine term unknown in India, and therefore a Sumatran change, while *Rajah* remains unaltered, as if from ignorance of the proper mode of adapting that title to a female princess. Once more, the remains of an antique fort Mr. Anderson tells us is termed *Kota-Jawa*, because supposed to have been built in former ages by the Javanese. *Kota* is the name of a fort in *Telugu*; and the same word is only a little modified in *Tamil*. This last reference may seem trifling. I conceive it is not so; for it gives a clue to the origin of Hindu names and antiquities, intimating Java as the possible medium of communication; and Java, as has already been stated, is full of antique Hindu vestiges.

"These remarks are but hasty and superficial. I apologise for them as such: yet I think a field of research is opened of some interest, as connected with the history and antiquities of a local section of mankind. The clue, ingeniously offered by Lieut. Newbold, I have endeavoured to lay hold of, and offer it to others. If the result be enquiry, and greater certainty than I can now assume, I shall be abundantly rewarded."

* Or more restrictedly *Parvati*; the consort of *Siva*.

XV.—Notices of Books.

1.—*Oriental Historical Manuscripts in the Tamil Language; translated, with Annotations.—By* William Taylor, *Missionary.* 2 *Vols.* 4*to. pp.* 600. *Madras,* 1835.

The issue, from the Madras press, of a work of the above mentioned character and dimensions, is a phenomenon in the literary history of our Presidency, which imperatively calls for a notice from the local Literary Journal; and, though the publication made its appearance some months ago, it is still sufficiently recent to warrant our adverting to it at this time, now that the enlarged scope and extended limits of this Journal enable us to do so.

It is right, at the outset, to apprise our readers, that, in the literary notices of this kind, which will, from time to time, appear in the pages of this Journal, it is not intended to conceal the fallibility of the Editor under the pompous editorial we of the English Reviews. Constituted as society is in this country, every individual of the small circle is, more or less, known to all the others; so that the Editor's incapacity would be known, to his ridicule and the discredit of the publication he conducts, should he arrogate to himself the ability to pronounce a judgment upon matters, which, it is well known, he understands little or nothing about.

The nature of his professional studies and employments, has prevented the Editor from bestowing much attention on oriental lore, so that, on occasions like the present, he will guarantee his readers from the infliction of his own crude, imperfect notions on the subject, by promising to appeal to the aid of the Committee of Papers, or to friends or correspondents well versed in the matters treated of.

On this occasion, we submit to our readers a brief analysis of the contents of the two volumes, drawn up by the learned translator himself, who kindly undertook to do so at our request. We shall merely premise, on our own parts, that the whole character and execution of the work displays great learning, profound research and critical acumen, on the part of the translator and annotator; and we should not faithfully execute our duty as public journalists, did we not earnestly call the attention of oriental scholars to its contents. To the junior branches of the Civil Service, we cannot but think, these manuscripts, in the common colloquial dialect, as well as other portions in the higher dialect, would be very useful. The work we hear has gained the suffrages of some of the senior members of that service. It is gratifying also to observe a very respectable list of subscribers prefixed. We hear that the work has attracted the attention in England of Mr. Richard Clarke, recently one of our first-rate Tamil scholars here; and, also, that the council of the Royal Asiatic

Society have expressed their approval of the design by subscription. The opinion of the latter body on the work itself may, perhaps, soon be gathered from their Transactions or Journal; the first volume of these translations certainly, and the second probably, being, by this time, on their table.

" The office of analysis, undertaken at the Editor's request, will be best accomplished by an outline of the contents before adding any observations. Of course the manuscripts, which are printed in the Native character, and translated on the opposite pages, seem to claim attention first, as the ground-work, though by no means the whole, of the translator's labours. The Preface announces that some of the manuscripts were originally collected, with a view to be sent to the late Colonel Mackenzie, though they eventually did not reach him, and they are not to be found in the Mackenzie MSS. at the College of Fort St. George. In the body of the work it is stated, that some smaller manuscripts, used in illustration of the others, were originally prepared by the head Bramin of the principal pagoda at Madura, in consequence of Mr. Ellis's request when visiting it; but failed of reaching that distinguished oriental scholar, in consequence of his death soon afterwards. The *Stalla Purana* of that pagoda was obtained direct from Madura, at a later period than the other documents. This local legend, it may be observed, was contained in the Mackenzie collection, in Sanscrit, under the title of *Halasya Muhatuuja*, and in Tamil under the title of *Perawolliar Purana.* The latter is still to be found at the College, and is the only one of the leading MSS. translated or abstracted in this work, and at the same time contained in that collection. This remark is made with the express exception of two or three subordinate MSS. in Tamil and Telugu, acknowledged as borrowed from the College, and made use of in illustrating the more modern portion of the history in the second volume.

" The leading design of the work is thus stated in the opening portion of the preface. " The principal subject of the work now submitted to " the reader is the ANCIENT SOUTHERN KINGDOM OF MADURA, so enti- " tled from its principal town. It is contained between 8° and 11° of " N. lat. and 95° to 97° of E. long. Its proper boundaries are the river " Cauvery, on the north, the bay of Bengal and Straits of Manar on " the east; Cape Comorin and the Indian Ocean on the south; and " the chain of Ghauts, or mountains, on the west. It is called " *Pandionis regio* by Ptolemy, being a translation of its native name: " and the capital town is by him spelt *Modura*, nearly the same with " its present appellation. The ancient native designation of the king- " dom is *Pandiya-mandalam*, or the *Pandiya territory*. The name of " the capital is properly *Mathurei;* and it also once bore the name of

" *Alavayi*, from a particular mythological legend to be found in the " body of the work. The boundaries of the kingdom have been stated " by various writers with unimportant differences. ***** The history " of the country, thus defined, is professedly the leading object of the " present work."

" In the first volume the leading MS. has been entitled by the translator, the *Pandion Chronicle.* It commences with the origin of time, and geographical divisions of the world, on the *Pauranic* view of those particulars; and, through many fabulous circumstances, comes down to the close of that very ancient, but well authenticated, dynasty; leaving much uncertainty surrounding an interval of anarchy and disorder. It includes a notice of the first Mahomedan invasion of the south, in the earlier part of the fourteenth century, together with some indications of other foreign ascendancy, not well defined, until an appeal made to the ruling sovereign at *Vizianuggar*, (or Bisnagur) led to an army being sent thither, and ending, through the medium of circumstances not needing here to be detailed, in the ancient *Pandion* kingdom of Madura coming under the rule of viceroys from Bisnagur, towards the close of the fifteenth century. Thenceforward the MS. gives a very brief sketch of the race of kings, the posterity of those viceroys; of the troubles occasioned by the Mahomedans at the close of this dynasty; and of the circumstances leading to British conquest and ascendancy.

" At an early period of the annotations on the *Pandion Chronicle*, an abstract of the *Stalla Purana*, or legend of the *Saiva*-temple at Madura is introduced, in the way of illustration; there being an evidently close relation between the two. At a later period a supplementary manuscript is introduced, as being fuller in an account of a period left obscure by the first MS., and in some respects differing from it, chiefly as regards details of that obscure period. Further, two MSS. containing the royal pedigrees of *Ayodhya* and *Hastinapuri*, or primordial Oude and Delhi, are given. The former was probably abstracted, by its native author, from one of the ancient *Puranas*, and the latter is an abridgment, by a native, from the poem of the *Mahabharata*, still further abridged by the translator. The remaining portion of the first volume is accompanied with annotations; and this division of the work forms the more ancient portion of the history.

" The second volume opens with the manuscript entitled *Carnatáca dynasty*, or a history of the northern viceroys, and the kings who descended from them. This portion, though modern, commencing about the middle of the 15th century, is yet accompanied with mythological fable at the outset. It is more full than the documents in the first volume, on the circumstances of that series of kings, though still very brief, if tried by the standard of modern European authors in

history. Between the *Pandion Chronicle* and the *Carnataca dynasty*, even with the aid of the supplementary manuscript, there is a chasm, or period of great uncertainty, from the 7th or 8th century of the Christian era, down to the 13th; and with a view to do something towards throwing light on that period, a connective survey follows the Carnataca Dynasty, in which its author has made large use of Professor Wilson's Descriptive Catalogue of the Mackenzie MSS.; comparing, in some places, the Professor's materials with his own; and, in a deferential manner, suggesting some modifications towards a general conclusion. This survey compresses a considerable portion of information within a small compass. The annotations are thenceforward resumed, with some aid from Ferishta's History of the Dekhan by Scott, and from his account of the Patan and Mogul empire by Dow: the smaller manuscripts, prepared by *Mirtanjeya Puttar*, the Head Bramin at Madura, for Mr. Ellis, here come into use, as illustrative of different portions of the leading narrative. At p. 139, a valuable use of the Mackenzie MSS. and Professor Wilson's notice of them is pointed out, as a check on Ferishta's carelessness and apprehended incorrectnesss; the more important as Ferishta's authority has generally been deemed almost conclusive. From p. 167 the translator commences making use of a Tamil writing and Telugu manuscript, obtained from the Mackenzie collection at the College, in amplification of the leading theme. The Tamil writing relates to the history of a Chief Poligar and his descendants, as interwoven with the history of the capital; and the Telugu MS. commencing from the accession of the son of the famous *Trimal Naig*, brings down the narrative, through various wars with Mysore, Tanjore, with Chanda Saheb and his partisans, and finally with Mahomed Ali of Arcot, down to the extinction of the royal line, and to their living in a village as merely private persons. It is stated that Lord Pigot intended to restore this line; but, with his death, hope expired. The latest of the *Mirtanjeya* MSS. is a document addressed to Government, as late as December 1820; and it represents the descendants of royalty as being in distress, from want of sufficient maintenance. Such are sometimes the transitions from worldly splendour.

"The Appendix contains a dissertation concerning the earliest location of mankind after the Deluge—translation of native descriptions of the respective heavens of *Siva* and *Vishnu*—the proverbs of a Pandion king, translated from the high Tamil dialect—geographical stanzas on the boundaries of ancient kingdoms, referred to in the work—a schedule of such Mackenzie MSS. in the list of Professor Wilson, as the Editor conjectured might be of value—some stanzas on the economy of aboriginal native courts, from the *Sataga* of a Tamil poet—and, lastly, a native account of the kings of Ceylon, with the trans-

lation of a brief MS. in Telugu, from the Mackenzie collection, concerning the *Sethupathis*, or *Marava* chiefs, originally feudatories to the sovereign of Madura.

"In the copious annotations and illustrations, which are scattered throughout the work, the writer has three leading objects in view; the one is, faithfully, to the extent of power and material, to illustrate a branch of history, long looked on as a hopeless void; another to exhibit, from the unsuspicious testimony of native documents, the real state and character of the mythology and religious ideas of the inhabitants of the region of which it treats; the third, to stimulate natives themselves to enquire into the validity of their religious credence, to remove from the minds of Europeans erroneous views, or estimates, of Hinduism, and to urge to all prudential and practical exertions for improving, both mentally and morally, the general features of the Hindu character. The writer is not one of the outrageous cynics, who can see, in that character, nothing but what is filthy and base and horrible, any more than he is one of the very opposite class, who have appeared to consider the Hindus as patterns of every virtue: his materials, with some edging of his own, point at the Bramins, as the real tyrants and enslavers of an otherwise, in many respects, amiable and intelligent people.

"Inclusive of some discussion (vol. 1, p. 152-167) on the reconciliation of the Mosaic narrative with geological systems of time, calling for attentive consideration, a chronological hypothesis, not to give it a stronger term, runs through the work. This is, that all Hindu records relate to no period of time higher up than the Deluge, most of them distinctly referring to it, in connexion with a series of floods and renovated worlds; that the ark rested on the mountains northward of India; that Hindustan was peopled direct from that seat of population, having no connexion with the migratory branch that founded Babel; that the Assyrians early invaded the peaceful settlers to the north of India; and that traces of the war are discoverable in Hindu mythological legends. Subordinate to this primitive question, is the discussion whether the *Pndion* kingdom was established by the offspring of *Durvasu*, an early scion of the *Hastinapuri* family, or whether it grew out of the invasion of Ceylon, by the famous *Rama* of *Ayodhya*, when he passed through the site of the *Pandion* kingdom, and collected there an army of monkies, or, more probably, of wild-men. The latter origin is indicated by Professor Wilson, grounded, as he states, on M.S. authority, while the Editor of this work, after inspecting that authority asserts that it does not bear the conclusion out. The possibility is that a sort of rude monarchy, or chieftainship, was already established when *Rama* made his famous incursion; unless, indeed, like the tale of Troy, the whole of the *Ra màyana* be a poetical fable.

"Subordinate to either of the other two questions, is, whether the whole mythological legend of the great Pagoda at Madura, has not been made, by the Brahmins of a former day, to turn upon the visit of the hero of the *Mahabharata* to the chief or king of that town, and marrying his daughter, as the *Mahabharata* itself asserts he did. The question is important only as to the origin of mythological fictions; and the reader of the work must decide. Faint indications may be perceived of an hypothesis tracing the influx of Brahmins into Hindustan, on all hands confessedly from the north-west, to a migration of a portion of the ten Tribes of Israel from their allotted station in Chaldea. Such an hypothesis, however, would require much further support to make it square with all Hindu records: hence it is cautiously introduced, with the expression of a wish to see the affirmative and negative arguments brought together in one synopsis; and, certainly, if such a synopsis be possible, it is desirable."

2.—*Illustrations of the Botany, and other branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere.—By* J. F. Royle, Esq., F. L. S., F. G. S., *&c. of the H. E. I. C. Medical Establishment.*

The early parts of this work have been already noticed, in No. 5 of this Journal, in an able article from the pen of Dr. Wight; we have now to note its progress in publication, the eighth number having lately reached India. The letter press and illustrations display undiminished interest and beauty. The latter exhibit the most successful application of the art of lithography to the illustration of natural history, that we are acquainted with, and we conclude it is to the employment of the stone that we are to attribute the moderate cost of the parts (20*s*), there being ten or eleven plates to each, with between thirty and forty pages of letter press, large quarto, most of the plates containing two, and many three, representations of botanical or zoological objects.

In No. 8 is the commencement of an account of the varieties of the tobacco plant, and the modes of culture best suited to it, which we shall notice when completed, as it relates to a staple article of Indian produce, and cannot but be of importance to the commerce and revenues of Madras.

We extract the following from a notice of Mr. Royle's work in the last number of the *Journal of the Royal Geographical Society*:

"India, according to its natural boundaries, stretches from 35° to 22°, with its peninsula extending to 8° of north latitude, and from 67° to 95° degrees of east longitude. Its extreme length and breadth are nearly equal, viz., about 2,000 miles: but its figure is so irregular that

its superficial area is not estimated higher than 1,280,000 English miles. It is bounded on the S. W. by the Indus, and on the N. E. by the Himalayan mountains, being washed on the two remaining principal sides by the Indian ocean. From its southern portions approaching so near to the equator, and its northern being nearly in the latitude of the south of Europe, great diversity may be expected both in the temperature of its climate and the character of its productions; and this diversity is further increased by the varying elevation of its surface in different places.

"The Himalayan mountains rise to a prodigious height in its immediate vicinity, and three other systems of mountains traverse it in different directions, viz. the western and eastern ghauts, which run parallel to the Malabar and Coromandel coast, and the Vindhya range, which runs east and west across the central part of India. The first of these is at once the loftiest, the most continuous, and rises the most abruptly from the sea. Towards its northern extremity, it rarely exceeds 3,000 feet in elevation; but as it approaches its junction with the Coromandel range, and forms with that the elevated tract called the Neilgherries, it is said to attain to the height of 8,000 feet, thence descending as it approaches Cape Comorin. The Coromandel range no where exceeds 3,000 feet, and is perforated by many considerable rivers, which, rising on the eastern slope of the western ghauts, flow, with scarcely any exception, to the eastward. The valley supported between the two ranges like them is of varied elevation, but also ascends from north to south. In Aurungabad and the Dukhun it does not surpass 1,400 feet; among the Neilgherries it reaches 7,000, and the diversity of its productions is thus in the double ratio of the differen ce of latitude which it covers and of elevation which it attains.

"It is not easy to define the exact extent of the Vindhya, or great central zone of Indian mountains. To the eastward it is found to deflect the united stream of the Ganges and Jumna, after their junction at Allahabad, and to the westward it is lost in the mountains of Guzerat. It thus constitutes a base to the triangle, of which the eastern and western ghauts form the other two sides, and completes the boundary of what is called the table-land of the peninsula. Its height is not supposed any were to exceed 3,000 teet, and it gradually declines both to the north and east from about 23° north latitude and 82° east longitude, where are its highest points. To the south and west it throws off many spurs, which become intermingled with the northern prolongations of the Malabar ghauts, and many rich and diversified valleys are found interposed between.

"North and west of the Vindhya range, the country descends into the valley of the Indus, of which the soil is generally sandy and covered with a saline efflorescence, and the water is brackish, and so far below the

surface, that the wells are from one to three hundred feet deep; while to the N. E. the alluvial plains of the great Gangetic valley are spread along the foot of the Himalayas, and with the gigantic system of mountains to which they are attached constitute the chief objects of Mr. Royle's research.

"Their ascent from the sea, in the bay of Bengal, is so gradual and uniform that Saharunpore, nearly at the foot of the Himalayas, where the East India Company has a botanical garden, long under his superintendence, is only 1,100 feet above the level of Calcutta: and a line drawn between them, through Delhi and Benares, with the ascertained elevation given to it proper to both these places (viz. 800 and 328 feet) would be nearly quite straight. The range of temperature at Saharunpore (lat. 30° N.) is from the freezing point in January to 105° in June, when the commencement of the rainy season prevents any increase of heat. This range admits of the cultivation of rice, millet, *Sorghum vulgare*, and tropical grains, as well as of the springing up of many annuals which require heat and moisture; but the extremes of temperature being far removed from each other in point of time, and the rise and fall being very gradual, a moderate climate is also obtained, from November to the end of March, which allows of the cultivation of wheat, barley, and other European grains, and the existence of species allied to, or identical with those of more temperate regions of the globe. And this double vegetation is a characteristic of an extensive tract of country in this direction. The fruit-trees of temperate climates, as the vine, orange, apple, pear, peach, &c., are thus, in particular, found to thrive well in districts of the great plain of India, in which they are in close juxta-position with plants of very different character, and requiring generally a very different soil and climate.

"In approaching the base of the Himalayas a close jungle is every where met with, and this produces the opposite effect, for by causing shade, moisture, and a less free radiation, it carries tropical plants into a temperature much colder than they would bear under ordinary circumstances. As the jungle becomes short and scrubby, in ascending the mountains, this effect ceases, but not before it produces the apparently anomalous circumstance of an equally tropical vegetation being found, at Deyra, at the elevation of 2,000 feet, as at Saharunpore in a somewhat lower latitude, and almost 1,000 feet less elevation. The palms are thus here brought in close contact with many of the hardiest *coniferæ*.

"After penetrating through the jungle, which with more or less denseness rises to 5,000 feet, tropical shrubs entirely disappear; and from the extreme rapidity of the ascent the zones of different characters of

vegetation become both more narrow and less specifically defined. Mr. Royle, however, reduces them first, generally, under two heads, viz., from 5,000 to 9,000 feet of elevation, and from the latter number to the highest limit of vegetation; and then enters into details regarding each, of extreme interest, but scarcely admitting of the necessary abridgement to suit our present purpose. We shall endeavour merely to seize some of the more prominent points.

"The height of 5,000 feet is chosen to mark the lower limit of the first division, because some few tropical perennials reach it, and snow seldom falls much below it; while the upper limit of 9,000 feet is in like manner selected, because to that height the snow always gives way before the rains set in, under the high temperature which characterizes the summer season in this latitude. Between the two, some few tropical herbaceous plants are still found, but the arboreous vegetation is exclusively that of temperate regions. Mr. Royle is minute in his details on both heads. He further points out the analogies between the Flora of this district and those of China, Japan, North and South America, the Cape of Good Hope, and some of the Atlantic islands. The double cultivation of tropical and hardy grains, as rice and wheat, already noticed as characterizing the plains at the foot of the Himalayas, is also found here, but rather on adjoining hills and valleys than on the same spots, though instances of this last also occur, arising in part from facilities for irrigation. The grasses are very rich and succulent within this district; wheat everywhere ripens well in it; the peach, apricot and vine thrive in it; the mustard tribe is extensively cultivated as yielding oil-seeds; and the potato, which has been recently introduced, is found to give heavy returns. In some districts, where fodder is scarce, cattle are fed on the leaves of certain trees, as *Grewia, Ulmus, Quercus*, and even some of the *Coniferæ*, these being stacked for the purpose. Mr. Royle also gives details regarding the zoology of this district, which partakes of the mixed character of its vegetation. Of monkeys the *Entellus* ascends to 9,000 feet. The tiger, leopard, and others of the feline tribe, follow their prey to nearly the same height. The wild dog and hog abound. The *Cervus Jurao*, or great stag, is common, as also the *Cervus Rutwa*, or barking deer. Antelopes properly belong to the higher region, but are found to stray also into this. The eagle and vulture are common; pheasants abundant; crows and jays frequent; cuckoos most common. Among insects, the glow-worm and butterflies closely resemble those of colder climates.

"The peculiarities of the lofty regions, on the other hand, closely and exclusively resemble those of high latitudes. The snow lying long, the increase of temperature, when it disappears, is very rapid; and

the growth of plants is proportionate. Perennial roots are protected, while annuals and the herbaceous parts of perennials are destroyed. The character of the vegetation rapidly changes in ascending. The more delicate plants disappear, and the vegetation becomes exclusively Alpine. Cultivation ascends, on the south side, only as high as from 9,000 to 10,000 feet : but on the north it is found as high as 12,000, though in both cases the crops are frequently cut green. Magnificent trees are found above this range ; and far above them again a close sward of highly succulent pasture is every where met with. The prevailing woods are *Quercus*, pines of many sorts, (especially *P. Webbiana*, *Deodoara*, *Excelsa* and *Morinda*,) *Rhododendron*, *Taxus*, *Betula*, *Acer*, *Cerasus* and *Populus*. The smaller trees are species of *Juniperus*, *Salix*, and *Ribes*. The grasses chiefly belong to *Agrostis*, *Poa*, *Festuca*, *Bromus* and *Phleum*. Ferns are not common ; but mosses and lichens abound.

" The striking circumstance above adverted to, of the line of cultivation and perpetual snow rising higher on the north than on the south side of the Himalayas, is well known : as is also, we believe, the reason usually assigned for it, viz., the lofty, yet comparatively level surface of the country to the north, from which heat is powerfully radiated into the adjoining atmosphere. But Mr. Royle adds the further fact, that precisely as the burning plains of India are left behind, and the outer passes of the mountains are penetrated, does this effect become progressively apparent. Thus cultivation on the southern flanks of the Himalayas no where rises above 6,000 feet : within the first passes it rises to 7,000; within the next to 8,000, and so on. In part the low level immediately over the plains of India may be attributed to a difficulty of irrigating, which is there also found ; but this neither accounts for it altogether, nor can it be considered even a powerful cause.

" Mr. Royle's statements regarding the fauna of the upper region of the Himalayas are extremely few. The range of temperature within the jungle district he considers to be from 32° to 105° ; and at 6,500 feet elevation, it has been found to be from 27° to 80°, with a medium temperature of 55°. His meteorological observations are not, however, formally given in any of the parts of his work yet published; and we shall not now carry our analysis of it further, content with having in the mean time indicated where a vast number of interesting statements regarding a most interesting portion of the globe may be found."

3.—*Plantæ Indicæ, quas in Montibus Coimbaturicis cæruleis, Nilagirî s. Neilgherries dictis, collegit* Rev. Bernhardus Schmid. *Illustravit* Dr. Jonathan Carolus Zenker, *Historiæ naturalis botanices que in Universitate literarum Jenensi Professor. Decas* I. Jena and Paris, 1835.

The first decade, only, of this work illustrating the Botany of that interesting region the Neilgherries, has yet reached India, but from this specimen we are enabled to form some judgment of what the work will be, and there is no doubt of its forming a most valuable accession to botanical science.

The part before us is in small folio, and consists of 10 coloured engravings of plants, executed in a superior style, with numerous illustrations of the minute anatomy of each; accompanied by descriptive letter press in the latin language.

The Reverend gentleman, by whose diligence and taste the collection was formed, forwarded the specimens to Jena, where they have been delineated and published, under the superintendence of the Professor of Botany at the University of that place, Dr. Zenker, who has contributed the botanical descriptions.

Mr. Schmid, who is still at Ootacamund, informs us that more parts are expected to arrive from Europe immediately; and he adds, " since the price, for which each decade is sold in Saxony, is so low as 3 *rix dollars,* the publication can be carried on and improved, only by a *great number* of subscribers being obtained." We hope that the work will meet with the support it undoubtedly merits; and we shall be happy to receive the names of those who may be desirous of becoming subscribers.

Dr. Zenker does not inform us, in his brief opening address, what is likely to be the extent of the work; he says only, that 10 *decades* will form a volume.

Dr. Wight, and the authors of the work before us, will perform for the Peninsula, what Dr. Wallich and Mr. Royle are doing for the northern parts of India; so that, at the present time, this country is well endowed with cultivators of botanical science. But we have to introduce to our readers a name, hitherto not so known to fame in India as we predicate it will shortly be, but which has already acquired a high reputation in Europe. We allude to Mr. Griffith, of the Madras Medical Establishment, at present employed under the Supreme Government as a member of the deputation to the Tea districts of Assam, the results of which are likely to prove of such vast importance to commerce as well as to science.

When we say that it is the individual of whom we speak that Professor Lindley alludes to, in the following passage of his Report on the

Philosophy of Botany, addressed in 1833 to the British Association for the Advancement of Science, we may abstain from offering our feeble eulogium. " This country has, till lately, been remarkably barren of discoveries in vegetable anatomy, since the time of Grew, who was one of the fathers of that branch of science. Whatever progress has been made in the determination of the exact nature of those minute organs, by the united powers of which the functions of vegetation are sustained, it has been chiefly in foreign countries that it has taken place : the names of Mirbel, Moldenhauer, Kiesor, Link and Amici, stand alone during the period when their works were published ; and it has only been within a very few years that those of Brown, Valentine, Griffith and Slack have entered into competition with the anatomists of Germany and France." Here, it will be seen, Mr. Griffith is classed with Brown—*Princeps Botanicorum,* the successor to the mantle of Linneus—as one of the founders of the English school of philosophical botany. Mr. Griffith has expressed a lively interest in the success of this Journal, and, what is likely to ensure that success, is, that we are to have his aid in the way of contribution.

4.—*Journal of the Royal Asiatic Society of Great Britain and Ireland.* Nos. 3 and 4.

Transactions of the Royal Asiatic Society of Great Britain and Ireland. Appendix to vol. 3d. 1835.

The *Journal of the Royal Asiatic Society* in *octavo* which our readers are already aware* was established in 1834, to supersede, in some measure, the more bulky *Transactions* in *quarto,* thrives admirably, we are happy to observe by the two last Numbers on our table.

These numbers contain a great deal of matter which might be made available for our pages; but as we are pressed for room, owing to the number and value of our original communications *(a cause for not extracting from other publications which we hope will always be in operation),* we can do no more than indicate the papers that seem to be particularly interesting to Madras readers. These are Dr. Ainslie's *Observations on Atmospheric Influence ;* Captain Swanston's *Memoir of the Primitive Church of Malayala ;* Colonel Sykes *on the Land Tenures of the Dekkan;* Captain Low's *History of Tenasserim,* Mr. Edye's *Description of the Sea Ports on the Coast of Malabar,* &c. The latter contains a great many very valuable observations, more especially on the timber, and other products, of the western coast of the Peninsula.

* Madras Journal, October 1834, p. 359.

From the 4th number of the *Journal* we have extracted the account of the Proceedings of the Anniversary Meeting of the Royal Asiatic Society for 1835, together with the Annual Report of the Council, which will be found in their proper place. These documents will afford the members of the Madras branch of the Society, and the readers of this Journal generally, an insight into the objects, plans and operations of the Parent Society, which we hope may be productive of some benefit to oriental literature and science, by stimulating individuals, who are present here on the spot, to follow up the views of those who, in distant England, are so energetic and zealous in the cause. The *Appendix* to the *Transactions* contains a paper by Mr. Goldingham, late of the Madras Observatory, entitled *Results of Meteorological Inquiries made at Madras*, a brief analysis of which, as possessing local interest, we submit to our readers.

It is not generally known that two thick folio volumes were published several years ago, entitled *Madras Observatory Papers*, containing the results of some of Mr. Goldingham's labours, while Astronomer at our then ill-appointed Observatory. More than ordinary care seems to have been devoted to the registry of meteorological observations, the details of which, extending through a period of thirty years, were printed in the above named publication. From these voluminous details the results have been lately condensed by Mr. Goldingham, and submitted in the shape above mentioned to the Royal Asiatic Society.

The first result offered by Mr. Goldingham is the hours of the day at which the Barometer arrives at the maximum and minimum as derived from hourly observations made in the year 1823—they are as follows :—

	Maximum.	*Minimum.*
	h. *h.*	*h.* *h.*
From observations during the first six months.....	10. 10A.M. and 10. 8P.M.	5.33P.M. and 3.83A.M.
From observations during the last six months.....	10. 14A.M. ....10. 6P.M.	5.42P.M. ....4. 38A.M.

The near agreement of these results for the first six months compared with those for the last six months of the year, tends to shew that the cause is a constant one in direction, and for the amount of effect we find the following :—

	First six months.	*Last six months.*
h. *h.*	*in.*	*in.*
The Barometer varies from 10 A.M. to 5 P.M.	0,078	0,080
„ 5 P.M. to 10 P.M.	0,060	0,066
„ 10 P.M. to 4 A.M.	0,038	0,032
„ 4 A.M. to 10 A.M.	0,054	0,040

It is desirable that continued observations should be made, here and elsewhere, to verify these results, as it is only by numerous as well as accurate observations that we can ever hope to detect the law which these variations follow.

The mean temperature and pressure from twenty-five years observations is as follows :

	Inches.
Barometer..	29.964
Thermometer......	81,700

and the mean monthly range, &c. during twenty-five years, between 1796 and 1821, is thus stated :

Months.	Mean monthly height for 21 years between 1796 & 1821.		Mean fall of rain for 13 years between 1803 & 1821.	
	Barometer.	Thermometer	Including the whole fall during storms	Fall in storms reduced to the Mean fall.
	Inches.	Degrees.	Inches.	Inches.
January.....	30,085	75,168	0,608	0,608
February.....	30,076	77,157	0,127	0,127
March	30,041	79,920	0,538	0,538
April.........	29,955	82,417	0,384	0,384
May.........	29,851	86,918	1,419	0,121
June.........	29,861	88,159	0,646	0,746
July.........	29,867	85,645	3,303	3,303
August.......	29,879	84,732	3,552	3,552
September...	29,908	83,825	4,824	4,824
October.......	29,942	81,858	11,294	11,294
November...	29,956	78,672	14,803	14,803
December....	30,074	78,843	8,618	6,048
Mean....	29,958	81,693	50,124	46,348

From the above table it would appear, that the Barometer arrives at its maximum 30,085 inches, some time in the month of January ; and that from this date to the beginning of May, it gradually descends towards the minimum 29,851 inches—quitting this it continues gradually to ascend again, until in January it has again reached the maximum—We notice that the Thermometer follows as nearly as possible an inverse order to this, it being at the minimum from the means of 25 years observation, on the 9th of January, and at the maximum on the 7th of June ; the maximum temperature in the shade when sheltered from the hot land wind is 107° , but when not so sheltered it has occasionally reached 115° —120°.

The following table, exhibiting the number of clear and cloudy days &c. in the year, will be interesting:

MONTHS.	Clear.	Cloudy.	Clear, hazy, cloudy.	Rain.	Dew.	Lightning.
	Days.	Days.	Days.	Days.	Days.	Days.
January.....	20	6	5	1	7	—
February....	24	1	3	—	9	—
March......	27	1	3	—	7	—
April........	24	2	4	1	2	2
May.........	19	4	8	2	—	4
June........	8	11	11	6	—	3
July.........	6	13	12	8	—	2
August.......	8	12	11	7	—	2
September ..	9	10	11	7	—	3
October.....	11	12	8	10	2	2
November...	11	13	6	9	2	—
December...	13	11	7	6	2	—
Annually by the Mean..	180	96	89	57	31	18

The winds most prevalent at Madras are, the *easterly or Sea Breeze* which blows more or less for several hours during every* day throughout the year—the westerly or *land wind* which sets in regularly on or about the 16th May, (blowing from 10 P. M. to 11 or 12 A. M. when it is relieved by the sea breeze) and continues till the middle of August—the *southerly* or *along shore* wind, sets in about the beginning of March and continues till the middle of May; and lastly the north east or monsoon, which sets in about the middle of October and continues till the end of February.

In conclusion we subjoin the following interesting extract :—

"*Gales of Wind and Storms.*—Gales of wind at Madras usually occur only during the rainy season, between the 15th October and the middle of December ; the barometer seldom sinks much more than four-tenths of an inch, or stands lower than 29.45 inches. These gales begin rather to the westward of north along the shore, veer to the westward, and increase in violence as they get round ; this change of direction continues, the wind gradually abating, until it is at south, when it frequently falls almost calm. From what has been just stated, the necessity for Ships in Madras roads getting under weigh immediately a gale commences is apparent ; as when the wind has veered easterly, it is next to impossible to get sea-room, and the vessels must be driven on shore.

* The sea breeze occasionally fails for 2 or 3 days in the month of June, when the heat is very oppressive.

"I shall proceed to give some particulars of gales occurring during the period comprised in the diary.

"On the 27th of October 1797, the moon having just passed the first quarter, and being at her greatest distance from the earth, there was a violent gale of wind at Madras, somewhat resembling the storms of late years; it began from the northward in the night between the 26th and 27th, veered to the N. E. and in the morning blew with uncommon violence during three hours. About noon it suddenly shifted to the south, and was almost as violent as before—many old trees were torn up by the roots, and the leaves on the north side of those much exposed, were either blown off, or completely withered. The barometer began to fall at about noon on the 25th, and at 2 o'clock P. M. on the 27th, had sunk to 29.465 from 30.005, or about 0.54 of an inch. This, though not so violent as the late storms, was no ordinary gale of wind.

"On the 10th of December 1807, the moon half-way between the first quarter and full, and nearly at the greatest distance from the earth, there was a gale at Madras. It began in the evening from the north, and was attended with thunder, lightning, and rain; veering to the southward of east, and blowing with violence, it slackened gradually after noon, and at 3 P. M. the sky was again clear. The barometer fell about 0.4 of an inch; rain 3½ inches. On the night between the 29th and 30th of March 1820, a strong gale of wind occurred; the moon at the full, but nearly at her greatest distance from the earth. This gale commenced from N. E. and blew with great violence at times; contrary to the course of the monsoon gales, it veered to the north, N. W., and S. W. still violent; but at the latter quarter it gradually slackened, and broke up at about 9 A. M. The barometer fell 0.40 of an inch, and was a little above 29.5 when at the greatest depression: about 6½ inches of rain fell. The ships left the roads in the evening; but some of the smaller craft were driven on shore, and others went down at their anchors. Several ships and smaller vessels were lost along the coast during the gale, which appears to have been more violent to the northward than at Madras.

"The storms we have had of late years at Madras resemble whirlwinds, blowing all round the compass (from particular points with incredible fury), and are generally confined to a space comparatively small in diameter. I shall also endeavour to give some of the leading features of these. On the 2d of May 1811, a violent storm occurred at Madras; the moon had passed the first quarter on the 30th of April, and was full on the 8th of May, and was also at her greatest distance from the earth. This storm raged with great fury, and did considerable mischief: I was in England at the time, but it appears, from what I can collect, to have begun from the northward, and to have blown equally strong from the east, S. E. and south. I did not, however,

find the details in the diary ; the barometer also was so much out of order, that nothing can be correctly stated regarding the actual quantity of depression.* The fall of rain was about five inches and a half. It appears from the notices published at the time, that early on the first of May the surf was observed to be unusually high, *while thick clouds continued to gather during the day from* N. E. ; and that by day-light on the second the wind blew very hard, accompanied by heavy rain. About noon it increased, and towards midnight had arrived at its greatest height, when it blew with incredible fury. A friend who was at the Presidency at the time, and who had great reason to recollect this storm, informs me, that raging with the greatest fury, it destroyed every vessel in the roads, with the exception of three, a small Spanish ship, an American, and a French cartel ship. These stood out to sea, but the former was driven on shore near Covelong ; ninety country vessels went down at their anchors, and all the rest were driven on shore, along with the Dover frigate and Chichester store-ship ; the whole beach having been covered with wreck and dead bodies for two miles north and south from Madras. The papers stated that the storm was not felt at the distance of forty miles from Madras.

"On the 24th of October 1818, a second violent storm occurred at Madras. The moon had passed the last quarter about two days, and was nearly at her greatest distance from the earth : the wind, which was a strong northerly gale early in the morning, before ten in the forenoon had increased to a storm. An awful pause of half an hour occurred about this time ; after which it blew a complete hurricane from the south, with a fury never perhaps before experienced at Madras. Some of the oldest trees, which had resisted the former storm, were rooted up ; and the largest branches of others were torn off by the force of the wind. In some trees of a tough description of wood, such branches were seen hanging down and twisted, having been whirled round and round by the fury of the storm. Such a scene of desolation was presented has had hardly been witnessed at Madras ; numbers of native habitations were levelled, many of the larger buildings injured, and some lives lost : several ships and brigs were at anchor in the roads. All these got under weigh, but the latter were driven on shore, and one of the ships foundered ; another was driven on shore to the northward, and a third rendered unseaworthy, while the others generally sustained great damage. The fall of rain was about five inches. The barometer had fallen between eight o'clock P. M. of the 23d and day-light of the 24th, nearly three-tenths of an inch, standing

* The depression shown does not appear to have been two-tenths of an inch, and consequently the instrument had scarcely any action.

at about 29·5 ; but during the awful lull at 10 A. M. it was at 28·780 inches, a most extraordinary and terrific depression, such as I never before heard of at Madras : towards noon it had risen about half an inch, and at sun-set was at 29·65 inches.

"On the 9th of May 1820, another storm occurred at Madras ; the moon having been between the third quarter and new, but at her nearest approach to the earth ; it commenced in the evening of the 8th, in a gale from the N. W., increasing and blowing very strong before morning, accompanied by torrents of rain. Violent gusts continued all day of the 9th, when the wind began to shift round to W. and S. W. blowing with greater violence, if possible, than before, and the rain still falling in torrents. Before noon on the 10th, the violence of the storm had subsided. This storm was of far longer duration than either of those that preceded it, but like them, accompanied by torrents of rain, and veering to different points of the compass. The damage on shore was great and distressing ; very many lives were stated to have been lost by this awful visitation, at and in the vicinity of the presidency ; most of the ships put to sea early, but great destruction took place among the smaller vessels : only one ship was lost : the tanks burst, and the rivers overflowed in all directions, to the great destruction of property. This storm appears to have had a wider range than the former. The barometer, which on the 8th in the forenoon was at 29.750 inches had fallen at sun-rise on the 9th, to 29.400 inches ; by noon, on the same day, to 29.135 inches ; and at 3 P. M. it was at 28.816 inches ; and at 5, at 28.670 inches, lower even than during the former storm. By sun-rise, on the 10th, it had risen to 29,633 inches ; and before noon, on that day, to the accustomed height of the time of the year. Between the 8th at night, and the 10th at sun-rise, about 16 inches of rain fell.

"It may probably appear somewhat extraordinary to those who consider the moon as having great influence in gales and storms, that at the times above noticed she was always (with one exception only) in a part of her orbit, when I believe she is considered by those just alluded to, as having the least influence. In one gale only was the moon at full, having also been mostly at the greatest distance from the earth.

"In four of the above instances the moon, upon a mean, passed the meridian at 30 degrees south of the zenith of Madras ; in three instances she passed at six degrees south, and the remaining two within about a degree to the northward ; and if one were inclined to draw any conclusion from the circumstances under which these gales and storms occurred, it might be, to ascribe to the moon a protecting power against such visitations, instead of aiding to produce them ; having been generally far removed from the earth at the time, and not in that part of her course where, acting in combination with the sun, she might be supposed to have the greatest influence"

5.—*Result of Astronomical Observations made at the Honourable the East India Company's Observatory at Madras.—By* Thomas Glanville Taylor, Esq., Astronomer to the Honourable Company. Vol. 3, for the Years 1834 and 1835. *Printed by order of the Madras Government.* Madras: 1836, p.p. 232, quarto.

Only twelve months have elapsed since Mr. Taylor's last volume made its appearance, and a third is now issuing from the press, in which are reduced two years observations, which cannot but reflect the highest credit on the ardent zeal and untiring assiduity of the Madras Astronomer; and, we are quite confident, that "these observations and results (which have been obtained only by continued hard labour, and after much anxiety) will, from their extent as well as accuracy, prove acceptable to Astronomers, and creditable to the Honourable Company's Observatory."*

This is the modest meed of applause which the author claims for himself, and we expect to see it most amply and cordially awarded by scientific men.

The principal observations, consisting of from 20 to 30,000, are, as usual, on the Sun, Moon, and Planets and fixed stars, and their effect has been, that an accuracy, to a fraction of a second of time, can always be attained at the Madras Observatory. The advantage of this to navigation need not be pointed out, the commanders of vessels frequenting this port being unable, by the ordinary means, to arrive at such exact results.

Mr. Taylor has invented a mechanical means, described in the *Journal of the Asiatic Society of Bengal* for May 1835, for the verification of the zero points of the instruments formed upon the collimation principle, which Sir John Herschel (who it seems had, about the same time, struck out something of the same kind himself at the Cape) has declared to be "a method of great importance, and likely to supersede every other method of examination."†

The progress of that wondrous celestial visitant, the Comet of Halley, whose re-appearance rendered celebrated the year 1835, was attentively watched at the Madras Observatory, and, but for cloudy weather, would have been seen here as early as it was in Europe. We extract the following remarks:

"The observations of Halley's Comet which now follow, do not commence until the 30th August 1835, although it is probable it might have been observed several days previously had not cloudy weather prevented:—From this date up to the 5th February 1836, and on April 3d, the observations were made with Dollond's 5 feet Achromatic

* Preface.

† *Journal of the Asiatic Society of Bengal,* vol. iv. p. 519.

mounted as an Equatorial after a plan proposed I believe by Smeaton: the telescope was supported upon a brick tablet surmounted by a slab of granite, into which I had introduced three pieces of brass, one having a conical hole, another a slit, and the third being a plane ; these were "run in" with boiling lead, and with the tablet were as secure as could be desired:—the power employed was 60, and the observation consisted in noting the time by the transit clock when the Comet or Star occupied the centre of the field of the telescope (as pointed out by a neatly defined diaphraghm placed in the focus of the eye piece); when the declination and hour angle were read off—the former which is read off from a circle of 7 inches diameter (graduated to every 30' but reading off to single minutes) can be depended upon to 1 or 2 minutes; whereas the latter (which is read off from a circle of 3¾ inches diameter graduated to every 4 minutes but reading off to every 20 seconds of time corresponding to 5' of a great circle) cannot I fear be depended upon to 3' or 4'. The observations on the meridian with the transit instrument were made by observing the time of disappearance behind the edge of a piece of paper pasted upon the second glass of the eye-piece; the paper thus pasted was seen very distinctly, and could with great accuracy be made to coincide with the centre wire.

" *Notes and Remarks.*—August 30. I had adjusted the instrument approximately only for the purpose of sweeping—on finding the Comet a further adjustment was made which (twilight approaching) only left time for two observations.

" August 31. Clouds prevented further observation.

" September 19. Continued cloudy weather every morning since the 31st.

" 20. The instrument very accurately adjusted—the sky particularly clear, and the Comet well defined, but not visible to the unassisted eye.

" October 17. Tail about 5° long—directed towards β Lyræ.

" 18. Rather hazy—tail 4° or 5° long.

" 19. Very clear, tail 15° or 20° long to my short sight, but one of the assistants with a sextant measured it 30° long.

" 22. The Comet appears better defined than I have yet seen it,—tail 15° long.

" November 5. The telescopic appearance has improved, but by reason of moonlight the appearance to the unassisted eye, is that of a nebulosity as bright as a star of the 4th magnitude.

" 6. The nucleus neatly defined—to the unassisted eye the tail appeared 7° long.

" 7. The tail appears very well defined, and certainly brighter than I have yet seen it;—in the telescope, its appearance is brighter in the

North than on the South side;—in the middle of it there appears a dark conical patch of about 10″ diameter at the base, which extends to a distance of 15′ or 20′ from the Comet; it there is very faint and blended with the tail, and at 30′ distance it is altogether lost: in the observations of the two last days, the hazy state of the air and presence of the Moon fully accounts for my not having noticed this before—whilst looking at this singular appearance, I cannot help fancying that the dark patch arises from the body of the Comet intercepting the light of the Sun, thereby causing the appearance of a conical shadow; to reconcile this supposition with the relative distances of the Comet, Earth, and Sun, it is necessary to suppose the Comet to be surrounded with an atmosphere of very considerable extent and of a highly refracting nature—the diameter of the Comet I estimate to be 10″ or 12.″

" 8 & 9. The above appearance continues.

" 18. The Comet was very distinctly visible to the unassisted eye, but by reason of trees obstructing the view from the station hitherto employed, I was obliged to remove the telescope to the verandah.

" December 23. Very distinct to the naked eye as a nebulosity.

" Jan. 19. Very distinct with a moderate light in the field.

" Jan. 31. The appearance of the Comet has much changed during the last seven days, the brightness being much diminished and the magnitude of the nucleus very much decreased, whilst that of the general outline has much increased: at present the diameter including the tail which surrounds it, is 10 or 12 minutes—visible as a nebula to the unassisted eye.

" Feb. 5. The appearance of the Comet has altered considerably (making allowance for the presence of the moon), the brilliancy has much diminished—it now appears as a faint nebulosity of uncertain figure.

" April 3. Air very clear—my assistant fancied he could see it without the assistance of the telescope when pointed out to him. I could not see it when on the meridian although clear—the appearance through the telescope was altogether visionary. I sometimes doubted if I did see it or no; the observations are however accordant.

" From a few of the early observations I have computed the elements roughly as follows:

Perihelion passage 1835 Nov. 16,19 Madras M. T.

	°	′	″
Longitude of Perihelion..........	304	12	10
„ of Ascending Node.....	55	9	16
Inclination........................	17	49	1
Ratio of the eccentricity..........	,967632		
Semi axis major..................	17,93705		
Motion...........................	Retrogade."		

The volume concludes with what, indeed, forms two thirds of the whole, viz. the mean Right Ascension and Declination, &c. of 3,000 stars—in addition to the 2,881 in vol. 2d—which must strike every one as the produce of immense labour and extraordinary perseverance. Our astronomical friend Juggarow informs us that "he has entered into a rough calculation, and ascertained the number of figures used in the computations to be above *five millions!*" By these, and other observations, of a similar nature, now in progress, Mr. Taylor expects to be able to settle the question regarding the motion in space of the Solar system.

PROCEEDINGS OF SOCIETIES.

Proceedings of the Anniversary Meeting of the Royal Asiatic Society, held on Saturday, the 9th of May, 1835.

The Twelfth Anniversary Meeting was held this day at one o'clock; the Right Honourable Charles Watkin Williams Wynn, M. P., the President of the Society, in the chair.

The Minutes of the last Meeting were read and confirmed.

The Secretary then read the Twelfth Annual Report of the Council. (Vide p. xxiii).

The Report of the Auditors was read by Lieut.-Colonel Doyle. (Vide p. xxvi).

Colonel Blackburne observed, that the careful attention displayed by the auditors in their report was so evident, that it required no eulogy from him. He should, therefore, simply beg to move that the thanks of the Society be given to those gentlemen for their services; and that their Report, together with that of the Council, be received and printed. This motion was seconded by Sir Henry Willock, and carried unanimously.

Lieut.-Colonel Doyle, in returning thanks on behalf of himself and brother Auditors, said, that although the general aspect of the Society's affairs was one of congratulation, it certainly would have been more agreeable could the Auditors have shewn a better state on the credit side of the Society's accounts; yet still he had no doubt that by active exertion the pecuniary means of the Society might soon be placed in a prosperous condition. He did not imagine, however, that any great reduction could be made in the expenditure of the Society, and, at the same time, allow the accommodation to members which was now afforded. But there was a mode by which these difficulties might be overcome. If gentlemen would only "put their shoulders to the wheel" by explaining the objects of the Society to their friends, and increase the number of contributing members, and also direct their efforts with a view to the procuring of public accommodation for the Society in some of the government buildings likely soon to be vacant; by such means the funds of the Institution would soon flourish. He trusted, however, that the next year's audit would be more favourable. It appeared, too, that a sum of three hundred and eighty pounds was due to the Society by the Oriental Translation Fund, an institution closely connected with the Society. It was an old adage, "that short reckonings made long friends;" and, for his part, he thought, that the sooner an adjustment of this account took place the better.

Sir Alexander Johnston, chairman of the Committee of Correspondence, read a memorandum enumerating the principal subjects which had engaged the attention of the Committee during the past year.

Sir Alexander then observed, in substance,* as follows:—

"From the statement I have just read, the meeting will see that during the last year the Committee have directed their inquiries to two subjects in particular; first, to the collecting of materials for compiling a history of the peninsula of India, south of the river Krishna; secondly, to the best means of introducing the sciences of Europe amongst the Hindu population of that part of India. With a

* As Sir Alexander was requested to reduce his observations to writing, we here only give such as were collected on the occasion.

view to the first, they have taken measures for ascertaining the value and extent of the materials which compose the Mackenzie collection; and for procuring such further materials as may be necessary to the completion of this work through the medium of the Hindu Society of Literature at Madras, of which Lutchmiah, the late Colonel Mackenzie's head assistant, is the president. The part of India to which these inquiries refer, is bounded on the north by the river Krishna, on the south by Cape Comorin, on the east by the coast of Coromandel, and on the west, by the coast of Malabar; and contains a superficies of about 140,000 square miles. This tract of country is of moral, commercial, and political interest, as well from its topography, population, languages, religious and civil institutions, agriculture, manufactures, and commerce, as from its ancient and modern history. The great chain of mountains, known by the name of the Eastern and Western Ghàts, separate the two coasts of this peninsula, the western coast being open to the south-west, the eastern coast to the north-east monsoon. Where the mountains ascend above a certain height, neither the south-west nor the north-east monsoon breaks over them; but where they are below a certain height, both monsoons break over them. In the Paligautcherry Pass, and in the Gulph of Manar, the influence of this chain of mountains, and of these two monsoons, is, independent of many other local circumstances, very great, both upon the vegetable and animal productions; and produces a greater variety in this part of India than is any where to be found in the same space within the tropics, as is fully shewn, as well by the difference between the productions on the coast of Malabar, and those on the coast of Coromandel, as by the production of the pearl oyster, of the chank-shell, and of the different modifications of coral in the gulph of Manar. The population consists of the different descriptions of people who inhabit the Neilgherry and other mountains; of the Hindu people who inhabit the low-lands, of the descendants of the Moguls and Arabs, and of people of the different nations of Europe who have from time to time established themselves in the several parts of the country. I must here mention that we are indebted to our Secretary for an interesting description of the former people.

" There are four principal languages; the Telugu, which extends from the Northern Circars to Pulicat, and which, from its softness, bears the same relation to the other languages in that part of India, as the Italian does to the languages of the rest of Europe; the Tamil, which extends from Pulicat to Cape Comorin, and which has a system of literature peculiar to itself, originating with the people amongst whom it is spoken; the Malayal'ma, which extends from Cape Comorin to Mount Dilli on the Malabar coast ; and the Canarese, which extends from that mountain to the Concan, and throughout the Mysore territories. All four languages may be said to belong to one family, because they have the same roots, although they differ so much in other respects as not to be intelligible to the people who do not belong to the countries in which they are respectively spoken. They are not of the same family with the Sanskrit, because they differ in their roots from that language, though they all contain a great many words derived from the Sanskrit. I am indebted to our Secretary, who has devoted so much of his attention to the people and language of the Neilgherry hills, and to the people of southern India generally, for a very curious fact relative to these languages. He tells me, if you extract from them all the words that are Sanskrit, you leave a language similar to the one which is at present spoken by the people of those hills.

" The religions which prevail in the Peninsula of India are the Brahmanical, the Budd'ha, the Jain, the Muhammedan, the Jewish, and the Christian, in all its

subdivisions of Nestorians, Catholics, and Protestants. Of the institutions, that which particularly attracts the attention of the statesman and the moralist, is the division of caste, which, whatever merit or demerit it may possess, must be looked upon as a great moral and political engine by which an able statesman may produce the greatest moral and political changes amongst the Hindús of India. There is a complete system of literature in the Tamil language, quite independent of that which belongs to the Sanskrit, containing works of its own on logic, metaphysics, ethics, and physics. A system of agriculture has been maintained from time immemorial, with the greatest care, by the construction of magnificent tanks or reservoirs for receiving and distributing the rain-water where there are no permanent rivers; and by the erection of stupendous artificial mounds for directing and changing the course of rivers, and distributing their waters in those parts of the country through which the great rivers take their course in their progress from the mountains to the sea. Barnard's map of the Jághír affords a fine illustration of the first; and the map in this Society of the course of the Caveri, through the Tanjore country, of the latter. The muslins, and various other articles, shew to what perfection the people of the country can attain in their manufactures; the quantity of coarse cloths formerly made in the southern provinces shew to what extent the demand may exist for the manufactures of those provinces, even in the most distant parts of the world; for, in former days, the Dutch brought gold dust from Sumatra, and other places to the eastward, then coined it into pagodas at Tutakorín, and with them purchased the cloths of the southern provinces, which, after being conveyed to Holland, and sold at Amsterdam, were painted at Bâsle, and other places in Switzerland, and then conveyed from Barcelona and Cadiz to all the Spanish colonies in South America.

"From the eastern coast, the people of the Peninsula carried on a trade with all the places in the Bay of Bengal, with all the eastern islands, and even with China; from the western coast, they carried on a trade with the Persian and Arabian gulphs, and through them with all the countries in Asia Minor and in Europe. This trade was coveted by every nation in Europe from the most ancient times, and was the object which, by leading Columbus to look for a short passage to the East, led him to the discovery of America; and that which, by leading Vasco de Gama to seek for a passage round the Cape of Good Hope, led him to the discovery of the passage by sea from Europe to India; and the great navigators who succeeded him, to the discovery of New Holland and all the places that have been since discovered in those regions.

"It was in consequence of the great importance that attached to an authentic history of this part of India, that the late Colonel Mackenzie first determined to make his collection. The following are the circumstances which led him to turn his mind to the subject. The present province of Madura, known in the days of the Romans by the appellation of the Regio Pandionis, had attracted great notice in those days, and an embassy was sent from the Pándyán kings to Augustus Cæsar at Rome. Even at that time the people of that country had a general system of education, a very extensive Tamil literature, and a college of great celebrity; literary merit was so highly esteemed by them as to overcome the feeling of caste; for Tiruvaluver, the author of many distinguished works in that language, though a Pariah by birth, was, owing to his literary attainments, elected, not only a member, but even the president of the college at Madura, of which men of the highest caste and highest distinction, were proud to belong. The same province became equally well known in Europe in the end of the sixteenth, and beginning of the seventeenth century, by the proceedings of the celebrated Jesuit mission,

which was established at Madura by Robertus de Nobilibus, who was distinguished by his talents, and by the thorough knowledge he had acquired of the Sanskrit and Tamil languages; and who seems to have intended, had his plans succeeded, to have founded a college at that place, for the purpose of disseminating the principles of the Christian religion, and the sciences of Europe, through the country, in the same manner as a knowledge of Tamil literature had been circulated through the same country by the ancient Tamil college established at that place. The province of Madura again became an object of literary interest in the eighteenth century, in consequence of my grandfather, the fifth Lord Napier, of Merchiston, having determined to write the life of his ancestor, John Napier of Merchiston, and to prefix to it a history of the knowledge which the people of India had of mathematics. It appearing by John Napier's papers, that he had, from the information he obtained during his travels, adopted the opinion, that numerals had first been discovered by the college of Madura, and that they had been introduced from India by the Arabs into Spain, and into other parts of Europe, Lord Napier was anxious to examine the sources from whence John Napier had derived his information upon this subject, and when he himself was abroad visited Venice and other places in Italy, in which he thought it was likely he should find an account of the information collected by the members of the Jesuit mission at Madura, upon this and other parts of Hindú science. Having been successful in obtaining some interesting documents relative to the object of his researches, he returned to Scotland, and submitted them to the then Mr. Mackenzie (afterwards Colonel Mackenzie), who had been recommended to him by Lord Seaforth, as a young man who had devoted himself to the study of mathematics. Lord Napier died before he had completed his life of John Napier, and Mr. Mackenzie, whose mind had been turned to the subject of Hindú science by Lord Napier, applied for, and obtained through Lord Seaforth, a commission in the East India Company's Engineers, on the Madras establishment, in order that he might have a favourable opportunity of prosecuting at Madura, the site of the ancient Hindú college, his enquiries into the knowledge which the Hindús possessed, in early days, of arithmetic, and the different branches of mathematics. On Mr. Mackenzie's arrival at Madras, finding that my father and mother (the latter being the daughter of his patron, Lord Napier, and then engaged in completing the life which had been commenced by her father), were stationed at Madura, where my father held a political situation of high trust under his friend Lord Macartney, he obtained leave from Lord Macartney, the then Governor of Madras, to join them. As soon as Mr. Mackenzie reached Madura, he began his inquiries relative to the ancient Hindú college of that place; and, in conjunction with my father and mother, formed the plan of reviving, under the protection of the English government, the Hindú college. In furtherance of this plan, my father having obtained from tne Nabob of Arcot, the then sovereign of the country, some deserted ruins in the jungle, about a mile from the fort of Madura, which were supposed to have been connected in former days with the proceedings of the Hindú college, built upon them at considerable expense, the house which has ever since been known at that place by the name of Johnston House, and which is still my property, laying out its different compartments, under the direction of Mr. Mackenzie, in such a manner as might best suit the adaptation of it as a building in which the mathematical instruction that Mr. Mackenzie wished to be circulated amongst all the natives of the country might be pursued. The pillars which supported this house were divided into six compartments, upon each of which all the diagrams were to be carved which were necessary to illustrate a course of arithmetic, geometry, mechanics, hydrostatics,

optics, and astronomy, there being a building erected upon the roof, in which plane and spherical trigonometry were to be taught; two orreries were to be erected, the one illustrating the Ptolemaic, the other the Copernican, system of the universe, and lectures were to be given in Tamil, Telugu, Malayalam, and Canarese, pointing out the superior utility of the Copernican over the Ptolemaic system, and the great practical utility to which the sciences of Europe might be applied in every department of practical knowledge. Mr. Mackenzie, shortly after he had finished this building for my father, was obliged to quit Madura on account of the public service, and the plan of the college was, owing to his absence, not then carried into effect. Mr. Mackenzie, some years afterwards, on passing through Madura in 1796, on his way to superintend the siege of Colombo, had extensive communications with several persons in the province of Madura, and in the other southern provinces, as to the practicability of recovering all the ancient histories of Madura, and of the other places in the south of the peninsula; and, in consequence of the result of such communication, formed a regular plan, which he studiously carried on for twenty-five years, for making the immense collection of historical materials, which forms the present Mackenzie Collection. In 1816, Colonel Mackenzie, finding his health rapidly declining, and anxious to leave some account of his collection behind him, in case of his death, asked me, with whom he had been acquainted from my earliest youth, to meet him at Madras, when he addressed a letter to me, which has been since published,* giving me a general view of his researches in India; with a request, that I would, in case of his dying before he had been able to arrange and publish a more detailed account of his collection, have it printed and published in such a manner as I might think proper. As I returned to England soon after, I mentioned the whole subject to the late Mr. Charles Grant, who was then Chairman of the Court of Directors, and he, in consequence of the circumstances which I mentioned to him, determined to propose to the court, that Colonel Mackenzie should be permitted to come to England, on his full pay and allowances, and remain in England three years, for the purpose of arranging and publishing such an account of the materials he had collected, as would enable some person to write from them an authentic history, ancient and modern, of the southern peninsula of India. However, accounts of Colonel Mackenzie's death having reached England some time after, no further steps were taken upon the subject. I published the letter which Colonel Mackenzie had addressed to me, and wrote to Lord Hastings, the then Governor General of British India, pointing out to him the great expense Colonel Mackenzie had been at in making the collection, amounting to upwards of 15,000*l.*, and expressing my opinion of the great utility of which such a collection might be to the British Government of India. Lord Hastings having ascertained upon the spot the value and extent of this collection, with his usual liberality and feeling for all scientific and literary pursuits, purchased it from Colonel Mackenzie's widow for 10,000*l.* A catalogue of it, in two volumes, has been made by Mr. Wilson, the Professor of Sanskrit at Oxford; one portion of the collection is in the Company's library in England, the other portion is in India. On the enquiries which took place before Parliament, two years ago, relative to British India, I was examined before a Committee of the House as to this collection; and felt it to be my duty, not only to express my opinion as to its value, but to point out the necessity of measures being immediately taken by the British government for enabling the two Houses of Legislature to avail themselves of the information contained in it, by employing our

* See Journal of the Royal Asiatic Society, vol. 1, p. 133.

secretary, Captain Harkness, and Lutchmiah, Colonel Mackenzie's native head-assistant, for completing and translating this collection in such a manner as Colonel Mackenzie would have done had he lived,—a step the more necessary owing to the age of Lutchmiah, and the impossibility, if any thing should happen to him or Captain Harkness, of finding any persons who were so capable as these gentlemen are, from their knowledge of Colonel Mackenzie's plans, of attaining the object which the legislature must have in view regarding this collection. Mr. Stewart Mackenzie, then a member of the Board of Control, and chairman of the committee, in the report of the committee, pointedly called the attention of the House to this subject.

" Conceiving that no time ought to be lost in taking such measures as might be requisite for completing in India the parts of the collection which might be defective, soon after I had been examined before the committee, I wrote out to Lutchmiah at Madras, enclosing him a copy of my evidence, and suggesting to him the propriety of his forming a Native Literary Society at Madras, for assisting the Royal Asiatic Society in collecting the information which they might require to complete the Mackenzie collection. Lutchmiah has formed a Native Literary Society at Madras, consisting of a great many zealous and well informed Hindús, whose object is to collect such useful information relative to India as may be required, and to adopt such means as may be necessary for introducing the sciences of Europe amongst the natives of the southern parts of India ; and has sent to us a printed copy of the regulations of that Society, which do honour to the zeal and good sense of the Society, and which are likely, if the Society be properly supported by the local government, to further the cause of science and literature throughout every part of the country*. The council have, at the same time, at my suggestion, applied to the Court of Directors, to allow Captain Harkness to examine the part of the collection which is at the India House library, and ascertain what steps should be taken for publishing such portions of it as are completed, and for completing such portions as are still defective ; it appears, by the report which Captain Harkness has already drawn up, a copy of which will, I trust, be attached to the proceedings of this day,† that the most authentic information relative to every part of the Southern Peninsula is to be found in this collection ; that it contains, either in fac-similes or copies, between 9,000 and 10,000 inscriptions, on copper or stone ; and that he himself is of opinion, that it affords the most ample

* The President of the Hindu Literary Society of Madras will see how much is expected of him and of the institution of which he is the head. We hope the exertions of Lutchmiah and his associates to illustrate the history, literature and antiquities of their native land, and to diffuse a knowledge of European science among their countrymen, are commensurate with the anticipations of Sir Alexander Johnston, expressed in this address, and in his evidence before the House of Commons. We are not able to enlighten the public on this head; but, perhaps, their progress towards these desirable ends may be as *sure*, as it certainly has hitherto been *silent*.

With regard to the much talked of Mackenzie MSS. we are happy in being able to inform oriental scholars, that there is a prospect of a satisfactory account being rendered of the nature and value of that portion of them still in the possession of the Madras Literary Society. The Rev. W. Taylor, whose name has been frequently before our readers, has already examined a large proportion of them, when in search of materials elucidatory of his researches, and he speaks very favourably of what may be expected from a careful examination of these MSS. This gentleman has kindly promised a paper, or series of papers, on the subject.—*Editor Madras Journal.*

† See page xxxvi.

materials for writing an authentic history of the whole of the southern peninsula of India.

"From these circumstances it is obvious that the Mackenzie collection does afford documents illustrative of what I have already described as one of the most important parts of our Indian possessions.

"With respect to the other subject of inquiry, the Committee of Correspondence have taken such measures as may be necessary to ascertain the best means of introducing in a more direct manner the sciences of Europe amongst the Hindús of the south of India. With a view to this point, they have inquired what degree of science they had attained in former days; what degree of encouragement was then held out to those amongst them who cultivated literature; and whether, raising their character by increasing their knowledge, is likely to increase their respect for, and attachment to, the British government.

"Science is employed in contemplating either the operations of the human understanding, the exercise of our moral powers, or the nature and qualities of external objects. When employed in the first, it is called logic and metaphysics; in the second, ethics; and in the third, physics. The committee have, therefore, endeavoured to ascertain the extent of the progress which the Hindús of India had, at any one time, made in each of those branches of science. It finds ample evidence in different parts of the poem called the *Mahábhárat*, that they had made about the same progress in logic and metaphysics when that poem was written, which is supposed to have been 1,500 years before the Christian era, as the Greeks and Romans had made during the most enlightened period of their history: and it is, therefore, fair to infer, that they had attained great accuracy in defining their ideas, and in drawing correct conclusions from their definitions in the more ancient times; for a poem that was so popular as it was amongst the Hindús, must, in order to have been so, have contained modes of reasoning and opinions which were generally understood, and generally liked by the people amongst whom the poem was circulated. It is, therefore, fair to infer, that a poem of this sort, for the reasons I have just mentioned, affords the best evidence which can be obtained of the opinions which were in general circulation in the country at the time the poem was written. The science of ethics has for its object to ascertain the difference between virtue and vice; the motives by which we ought to be guided; and the general rules for regulating our conduct in society. This science, judging by the opinions of the author of the *Mahabharat*, seems to have attained amongst the Hindus the same degree of perfection 1,500 years before the Christian era, as it did in Greece and Rome during the best days of the Stoic philosophy. In the science of law, the Hindus, according to the institutes of Menu, and their most ancient law-tracts, seem to have made as great a progress in the earliest times, as the Greeks seem to have done in the days of Justinian; and to have exceeded the Greeks, and even the Europeans of the middle ages, in that branch of it which related to commerce; the laws of the Greeks and the laws of the English having, up to the seventeenth century, restricted the allowance of interest on all contracts to a fixed sum without any exception whatever—the Hindu law, on the contrary, always making a distinct exception in cases of adventures at sea; though such an exception had never been made in the laws of England till the time of Charles I., when a knowledge of the true principles of commerce had made great progress in England.

"In physics, the progress of the Hindus seems to have been equally remarkable in the earliest period of their history. In arithmetic, they were always believed to be the first who adopted the system of notation by ten numerals, in-

stead of following that of noting by the letters of the alphabet. The mode of noting by ten numerals, which consists in giving the figures a particular value or a particular power, according to the relative position in which they are placed, is an invention of the greatest importance from its simplicity and its ingenuity, and from the effect which it has had in promoting and facilitating the progress of science. It was known to the Hindus, though unknown to the Greeks and Romans, who always used the letters of the alphabet, instead of numerals, in their calculations; and the notation by numerals was first introduced into Europe by the Arabs, when they conquered Spain in the seventh and eighth centuries, and though at present so universally used, was at first confined to scientific persons, and not introduced into the common transactions of life until two or three centuries afterwards. This knowledge of numerals, for which Europeans are indebted to the Hindús of India, assisted Napier in his discovery of logarithms; Kepler, in his calculations of the orbits of the planets; Sir Isaac Newton, in all the sublime calculations which he made with respect to the system of the universe; and La Place, in the celebrated discoveries which he made in very recent times. It is generally observed, that where a people have made great progress in arithmetic, they have also made great progress in other branches of science, arithmetic being the great engine through which such progress is made. For some years the world was not aware of the great progress which the Hindús had made in other branches of science, although they were perfectly aware of the progress they had made in arithmetic. Laloubere, a man of great research, who was sent by Louis XIV. on a mission to Siam, was the first person who in modern days brought to Europe any document shewing the nature of the Hindú astronomical tables. He brought to France a copy of the Siamese table, which was a subject of a good deal of consideration to the astronomer Casini. The French subsequently brought to Europe the Hindu astronomical tables found at Krishnapuram, those found at Narsapúr, and, finally, those found at Trivalore, a place twelve miles to the west of Negapatnam: these three places are all situated in the southern peninsula of India. The astronomical tables found at Trivalore are supposed to have been formed upon observations made 3,000 years before the Christian era,—a fact which Bailly and Playfair both conceived to be proved, as they found, upon calculating back to the time when these tables were supposed to have been formed, that the situation of the heavenly bodies must have been precisely such as described in these tables. Bailly and Playfair also remark, that the Hindús could not have formed these tables without an extensive knowledge of geometry, and of plane and spherical trigonometry, or of some substitute for them. It is also remarked, that these tables must have been formed at some of the places in the Southern Peninsula, which are situated between the Hindú meridian, which runs through Cape Comorin, and that which runs through the eastern part of Ceylon, and, consequently, not far from Madura, the ancient seat of the celebrated Hindú college*. From what has been said, as to the great progress made by the Hindús in logic, in ethics, and in physics, it is obvious, that the Hindús are capable, if properly instructed, of attaining the highest degrees of knowledge and science.

* The pretended antiquity of these tables is satisfactorily disproved, on the unquestionable authority of La Place, by a writer in the *Edinburgh New Philosophical Journal* for January 1836.—*Editor Madras Journal.*

" With respect to the motives which are likely to stimulate them to direct their attention to science, it appears, if we refer to the literary age of Vikramáditya, in the north of India, and to that of the Hindu College of the south of India, that the rewards which were held out for the encouragement of literature were public honours and distinctions. We have evidence that the love of public honours and distinctions is at this moment one of the strongest motives for exertion amongst the Hindús, this is proved by the avidity with which such of them as have been appointed under the new act, king's justices of the peace, have claimed from government, and received the honorary title of esquire, and by their having applied to Sir Charles Forbes to have seals made for them in this country, with arms engraved upon them descriptive of their families, and of the manner in which they, or their ancestors, have distinguished themselves.

" With respect to the feelings which they are likely to entertain for the individuals who have taken means for raising them, either by a scientific education, or by conferring upon them political rights and privileges, we have evidence in their affection for and conduct towards Sir Charles Forbes. If we refer to the proceedings of parliament when Sir Charles Forbes, fortunately for the natives of India, had a seat in the House of Commons, or to the proceedings of the Court of Proprietors of East India Stock, we invariably find the name of Sir Charles Forbes associated with every measure that is calculated to raise and protect the natives of India. The natives of Bombay, some time ago, sent to England a petition to the House of Commons, signed by between four and five thousand inhabitants of all the different religious sects, and of all the different castes of the inhabitants of that presidency, asking for those privileges and rights which they think of importance to themselves. They wished this petition to be entrusted to a person of whose friendly feelings to them they were all thoroughly convinced; and though the persons signing it differ from one another upon every other point, they all agreed in this one, that Sir Charles Forbes, from his invariable conduct in endeavouring to raise them in society, was the fittest person to patronise this petition.* Sir Charles Forbes has lately given a copy of this petition to the Society; it is a curious document, from the number of autograph signatures to it of people of all religious persuasions and castes at Bombay; and enables me to produce the strongest evidence which can be afforded, of the feelings which the natives of India will always entertain for an individual, or a government, who may take measures for raising their moral and political character.

" From all these circumstances I am authorised to conclude, that the Hindus of the Peninsula of India, having, in former days, when properly encouraged, made the greatest progress in science and literature, may at present, if so encouraged, make equal progress: that public honours and distinctions were the cause of that progress in former days; that public honours and distinctions may be rendered an efficient cause of the same progress in the present day; and that the government which endeavours to raise their character will be looked upon by them as deserving of full confidence and affection. Of this we have the strongest proof in the history of Akbar. That great and enlightened sovereign, after the most minute inquiry into the character of his Hindú subjects, declared them to be as worthy of his protection and encouragement as his Muhammedan subjects;

* As this document, written by the natives themselves in three different languages, in order that all those who signed it might be aware of its contents, affords a curious illustration of the present views of the people of India, a copy of it is inserted in this Journal.

and his celebrated minister, Abulfazl, after an equally attentive observation of their character and capacity, declared them to be persons worthy of the greatest respect and highest confidence; and a people who had attained the greatest distinction in arts, science, and literature. Upon these views the Emperor Akbar, during a very long reign, acted towards the Hindus, and received from them, at his death, the title of "Guardian of Mankind."

Sir George Staunton rose to move a vote of thanks to Sir Alexander Johnston for his very able Report, accompanied by a request that he would reduce his observations to writing, in order that they might be printed in the Journal. He said he felt assured that every one who had listened to that Report, and who was aware of the important services which Sir Alexander had rendered to the Society from year to year since its first institution, must be happy to take this mode of conveying to him the expression of the grateful feeling of the Society, and its wish that the very valuable information he had given them should be preserved in a permanent shape on its records. He thought it would be a waste of words to detain them longer in direct support of the motion; but he felt it to be his duty, looking to the interests and future welfare of the Society, to draw their attention to the advantage it would derive from so excellent an example being more generally followed. While the Society comprised within its limits so many distinguished individuals, capable, from their talents and experience, of promoting in a similar manner the important objects for which it was instituted, it was to be hoped that they would not suffer their powers to remain dormant, but exert them with the same zeal and perseverance as exhibited by his right honourable friend. Sir George said he felt more anxious at this moment to draw the attention of the meeting to the expediency of increased exertions on behalf of the Society, as it seemed to him that it had now arrived at what might be considered a critical period of its existence, at its twelfth anniversary. It was a matter of congratulation that it was now completely organised, and that it included in its lists almost every distinguished name, native as well as foreign, in Oriental literature. It was now not merely a literary and scientific institution for the interchange of useful and agreeable information among its own members, but it evidently possessed powers of collecting and diffusing information respecting the condition and interests of our vast Indian possessions, the cultivation of which was of great public and national importance. But it was impossible that these powers could be fully developed in the publication of the numerous communications they had received, and in the suitable disposal for general benefit of their increasing library and museum, without some public assistance. It was obvious that, with every private exertion that could be made, the Society must languish in comparative inefficiency without some kind of national support. He ventured, therefore, respectfully to appeal to the members of the Society who were of his Majesty's privy council, and especially our distinguished president, whose representations of its claim to suitable apartments for its accommodation, whenever any were at the disposal of government, he felt convinced, whatever political party might be in power, must ultimately be listened to. He hoped he might also venture to make a similar appeal to the Directors of the East India Company who were members of the Society; well knowing that the liberality of the Company, when appealed to on just and public grounds, had never been wanting. The government and the Company could not but feel, that such an association of talent for the diffusion of knowledge connected with our Eastern possessions, was an instrument in their hands that they could not create; but which, since it now existed, it was most desirable, as well as politic, to foster and cherish for the public benefit.

Sir George said he could not sit down without adverting to the lamented loss of the Rev. Dr. Morrison, noticed in the Council's Report. Having maintained an unbroken literary and friendly intercourse with that amiable and eminent individual for twenty-seven years, he had peculiar opportunities of estimating his worth. When he reflected on his vast work of a complete English and Chinese dictionary, and his entire version of the Holy Scriptures into the Chinese language, and the important uses of these two great achievements, he could not but consider that such a union of Christian zeal and eminent learning, so usefully devoted to the good of mankind, had rarely, if ever, been exceeded. Sir George concluded by submitting a motion of thanks to Sir Alexander Johnston, which was seconded by James Alexander, Esq. and carried unanimously.

Lieut.-Colonel Sykes suggested, that, as apartments in Somerset House were likely, he understood, to be vacated by another society, he thought an early opportunity of putting in a claim for them should be taken by the Society.

Charles Elliott, Esq. in moving that the thanks of the Society be voted to its venerable director, could not, he said, allow this opportunity to pass without reiterating his expression of extreme regret that ill-health had so long deprived the Society of that gentleman's personal assistance. Seconded by Samuel Dyer, Esq. and carried unanimously.

The Right Hon. Sir Alexander Johnston proposed a vote of thanks to the Right Hon. C. W. Williams Wynn, the president of the Society, which was seconded by Sir George Staunton, and carried unanimously.

Mr. Wynn, in returning thanks, said he really had on so many occasions, during his twelve years' presidentship to the Society, received the kind support of the members, that he could not doubt of that kindness being still continued to him, however feeble might be his efforts to deserve it. He had great pleasure in witnessing the very full attendance here this day; and that fact was itself a powerful argument to shew how desirable it was that the Society should be more advantageously located. Gentlemen would allow him to say, that he felt the importance of this object as strongly as any person; nor had he been wanting in his endeavours to forward it. With respect to the apartments at Somerset House, a representation on behalf of the Society had been made, three or four years ago, to Lord Althorp, and, since that time, very recently to Sir Robert Peel, and he must say that both these parties received the representations in the most favourable manner. However, it seemed to him very doubtful, as regarded the rooms in Somerset House, whether they would not be required as public offices for the use of government. Moreover, it was not at all likely that the apartments in question would be vacated in so short a time as a year, as the new National Gallery would scarcely be completed in that period. He had been assured, that when that time did arrive, the claims of the Asiatic Society would meet with due attention, and would be considered as at least equal to those of any other Society.

After a short eulogium on the late Dr. Morrison and Major-General Hardwicke, whom the Society had lost during the past year, the right honourable gentleman went on to say, that, since the last anniversary, two circumstances had happened, to which he could not help alluding. The one was the publication of the valuable and interesting Travels of Lieut. Burnes, a second edition of which was now before him. The Council of the Society had already presented that gentleman with a diploma as Honorary Resident Member of the Society; and although the value of that presentation was, in a pecuniary view, a trifling matter, it was a distinction which the Society had conferred on Lieut. Burnes alone, and, as such, fully proved its high sense of the merits of that distinguished traveller.

The next circumstance was the mission of Capt. Chesney to investigate the practicability of establishing a communication by steam with India, either by the Euphrates or the Red Sea. If that were done, we should bring India more immediately within our scope; and should then be enabled to communicate and receive an answer to our letters in four months, while now it took at least a year. He also looked to that expedition as being calculated to furnish much valuable information on many subjects, as Captain Chesney was accompanied by several able and scientific coadjutors. He felt we were highly indebted to the late president of the Board of Control, now Lord Glenelg, and to another gentleman, whom he had the pleasure of seeing in the room, Mr. Stuart Mackenzie, for that mission ; and, also for the peculiar interest they had shewn in all matters connected with India. The right hon. gentleman concluded by thanking the members for the kind way in which they had voted the thanks of the Society to him; and expressed his hope that he should have the happiness of meeting them at the dinner that evening.

Upon a remark being made by Colonel Sykes, Mr. Wynn observed, that if, as was possible, the museum of the East India Company should be united with the Society's, still greater space would be required; but that he was sanguine, on such an event, accommodation might more readily be procured, and that the Society would then soon be relieved from the present heavy expense it was at for house-rent.

Sir George Staunton said, in allusion to the contending claims of societies, Lord Althorp had expressed his opinion that, if a vacancy should occur in any public building, the claims of the Royal Asiatic Society should have the preference.

Sir Alexander Johnston remarked that, as the Society might be made a powerful auxiliary for the good government of India, its support should be considered by an enlightened governmeut as a matter of the greatest moment.

John Goldie, Esq. moved the thanks of the meeting to the vice-presidents of the Society, which was seconded by Sir Ralph Rice, and carried unanimously.

The Right Hon. Henry Ellis rose to move a vote of thanks to the council, on whose exertions, he said, much of the Society's success depended. In reference to the late Dr. Morrison, Mr. Ellis mentioned an instance which had come under his own observation, and which proved the value of that learned man's labours in a national point of view. On that occasion, a very difficult paper was put before the Doctor, to be translated into Chinese, which he did with as much ease as the draft had been written with, and, he believed, in a perfectly unexceptionable style. He thought that that extraordinary individual deserved some mark of national gratitude.

J. A. Stuart Mackenzie, Esq. in seconding the motion, remarked, that he thought the best method for procuring some public support for the Society would be, to make an application to parliament, and he hoped the right hon. President would undertake to bring the matter before that house. He did not doubt that the claims of this Society, so intimately connected as it was with the future interests of India, would meet with a fair consideration from any government. He took blame to himself, that this should be the first anniversary of the Society at which he attended ;—more especially when he remembered how long he had been connected with the Board of Control. It would now, however, be his gratifying duty to endeavour to make up for lost time, by paying in future double attention to the interests of the Society, when he had no longer the honour or advantage of being a member of that board. India and Indian interests must become familiarised every day, more and more, to Englishmen ; and this Society could not fail to exercise a most beneficial and essential influence in advancing a more general knowledge of

all that was connected with our mighty eastern empire. He felt flattered by the manner in which his name had been noticed by the right hon. president, to whose discretion he wished to see intrusted any motion before parliament which should have reference to this Society and its advancement, when it should receive his best attention. It would always be a source of satisfaction to him to have had his share (however humble) in the inquiry which was carried on last session before a committee of the House of Commons, and which terminated in so liberal a grant of public money as parliament had placed at the disposal of the government, with a view to put to the test of experiment, by an expedition under Captain Chesney, the practicability of facilitating the communication with India by means of steam navigation on the river Euphrates;—a measure of the deepest interest and importance to our empire in the east, whether considered in a commercial or political point of view. Whatever might be the issue of this great experiment, he should always be ready to take a full share of responsibility in supporting the grant of public money for this most arduous and interesting enterprise.

The motion was then put from the chair, and carried unanimously.

Andrew Macklew, Esq. proposed that the thanks of the meeting be given to James Alexander, Esq. the Society's treasurer: seconded by Richard Clarke, Esq. and carried unanimously.

Mr Alexander, in returning thanks, observed, that, as treasurer to the Society, he only wished he could see a solid and regular increase in the revenues of the institution; but truth compelled him to say that at present it was not the case. He did not like the Society trusting to contingencies; he wished it to be able to look every proper object in the face. He thought he sawa prospect of an increase of expenses without a corresponding increase of funds. He, therefore, called upon every gentleman present to use his utmost exertions to augment the income of the Society.

Captain J. Michael moved a vote of thanks to the secretary of the Society, expressing a hope that it might long enjoy his valuable aid: seconded by Colonel Boardman, and carried unanimously.

Captain Harkness said, he felt highly gratified at the very flattering manner in which his name had this day been mentioned. It would always be a pleasure to him to afford any aid in his power to promote the prosperity of the Society; that aid, indeed, was feeble, and but little deserving the eulogy with which it had been alluded to; but of one thing he was sure—that it was given with a perfect willingness of heart and mind; and, in the same sincerity, he now begged to return his best thanks.

The Right Hon. Chairman submitted to the meeting a recommendation from the Council, "that the chairman, for the time being, of the Honourable the Court of Directors of the East India Company, be requested to accept the office of Vice-Patron of the Society."

On the question being put, it was unanimously resolved that the recommendation of the council be adopted.

The Chairman then submitted the following recommendation of the council, "that his Majesty Muhammed Shah, Shahen Shah, King of Persia, and His Highness Mahárájá Runjít Singh, Rájá of the Punjáb, be elected honorary members of the Society."

Carried unanimously.

The meeting then proceeded to ballot for the officers and council for the ensuing year, Henry S. Græme, Esq. and Thomas Newnham, Esq. being nominated scrutineers. On the termination of the ballot, the president announced that all the officers were re-elected, and that the following changes took place in the council:—

Sir R. Rice; Sir C. Forbes, Bart.; N. B Edmonstone, Esq.; Lieut.-Colonel C. J. Doyle; Major Carnac; Colonel Francklin; Major Close; Richard Clarke, Esq.: in the place of the Hon. Mountstuart Elphinstone; Sir R. H. Inglis, Bart.; W. B. Bayley, Esq; Lieut.-Colonel Bowler; Lieut.-Colonel W. M. G. Colebrooke; Charles Elliott, Esq; Richard Jenkins, Esq.; and Professor Wilson.

The next General Meeting was announced for the 16th instant.

Twelfh Annual Report of the Council; May 9th, 1835.

The Council of the Royal Asiatic Society is again called upon, at the close of another year, to lay before the members a brief review of the Society's history and proceedings during that period; and, in performing this part of its duty, it has the gratification of being able to appeal to the facts contained in this Report, for the most satisfactory evidence of the Society's extended usefulness and undiminished prosperity.

The Council has the painful task of premising, with deep regret, in which it is persuaded the members of the Society will fully participate, that, although the venerable director, Mr. Henry Colebrooke, still gives the Society the sanction of his name, and takes the warmest interest in its welfare, the unfavourable state of his health continues to disable him from performing those personal services, which, from his great talents, his profound erudition, and correct judgment, have been, at all times, so valuable and important, and so highly and justly appreciated by the Society.

Although, from the auditors' Report on the pecuniary receipts and expenditures, it is seen, that, at the end of the year 1834, a balance of 50*l.* 1*s.* 4*d.* remained due by the Society to the treasurer, yet the Council feels assured, that, when the members take into their consideration the necessarily large expenditure attendant on the publication of the elaborately illustrated work of Ram Raz on Hindu Architecture, this balance must appear to them extremely small. And the Council trusts, that the credit reflected on the Society by bringing before the public a work of so much rarity and importance, will fully compensate for the temporary encroachment of this expenditure on the funds of the institution.

The Council deems it a matter of congratulation, that the number of deaths and retirements of the members of the Society, since the last anniversary, has been less than in most former periods; while the number of elections of new members has exceeded the usual average, leaving a considerable numerical balance in favour of the Society.

In recording the names of those members of whom the Society has been deprived by death during the last year, the Council has the painful duty to enumerate the following:—The Right Hon. Earl Bathurst, K. G. F. S. A.; the Right Hon. Earl Spencer, K. G. F. R. S; Baron William Von Humboldt; Major General Thos. Hardwicke, F. R. S.; Lieut. Colonel David Wilson; the Rev. Dr. Morrison, F. R. S.; Major James Franklin, F. R. S.; John Caley, Esq. F. R. S.; Thomas Snodgrass, Esq. F. R. S.; Francis Shore, Esq.; Patrick Heatly, Esq.; Robert Dent, Esq.; John St. J. Long, Esq. M. R. L. S.

The important and valuable additions which have been made to the library and museum during the past year, call forth the warmest acknowledgments of the Council towards the several donors.

It would be a pleasing task to pass in review all those donations; to mark in how many instances they have supplied deficiencies, and how many distinguished names have taken this method of expressing their good-will towards the Society,

and their desire to further its objects. But the limits of this Report forbid a detailed enumeration, and oblige the Council to restrict itself to the notice of a few only of those contributions which appear to possess peculiar interest or value.

Captain James Low has forwarded to the Society a voluminous manuscript account of Tenasserim, drawn up by himself during his residence in that country, and illustrated with numerous maps and drawings.

Of the interesting and original information which the author has collected by personal observation and inquiry, the Society has had an opportunity of judging from the extracts which have been read at its late meetings; and the Council further intends to enrich, from time to time, the pages of the Journal with the more attractive portions of the work.

Mr. Shakespear has presented a copy of the third edition of his Hindústání and English Dictionary, of which the learned and indefatigable author has enhanced the value (already so high in the estimation of the first Hindústání scholars), not only by numerous additions in the body of the work, but also by appending a copious index, fitting it to serve all the purposes of an English and Hindústaní, as well as a Hindústání and English dictionary. The "Additional Part," embodying a large collection of words in the Dakhaní dialect, supplies a desideratum long felt by the Hindústání student.

There has also been received from the learned Professor Garçin de Tassy his critical edition of the complete works of Walí, a highly popular Hindústání poet. The publication of this work, written in the dialect of the Dekkan, supplies another desideratum in Hindústání literature, and forms a seasonable and useful accompaniment to the work above mentioned.

Professor Flügel has presented his accurate edition of the Arabic text of the Korán, printed in a beautiful and distinct type, cut expressly for the purpose, under the superintendence of Tauchnitz, the spirited publisher of the work.

To that distinguished hydrographer, Mr. John Arrowsmith, the Society is indebted for the valuable present of his "London Atlas of Universal Geography, exhibiting the physical and statistical Divisions of the various Countries of the World."

This work, the fruit of much patient and laborious research, and embodying the results of the latest discoveries of travellers, reflects equal credit on the industry and talents of its author.

From the Asiatic Society of Bengal, the Society has received a copy of the "Dictionary of the Tibetan Language," by M. Csoma de Körös, the learned Hungarian, of whom a biographical notice appeared in the first volume of the Society's Journal.

Ram Comul Sen, of Calcutta, has forwarded a copy of his "Dictionary, English and Bengali, compiled from Tod's edition of Johnson's English Dictionary."

The establishment of a printing-press at Teherán, by the late Abbás Mírzá, must suggest the most agreeable anticipations to the minds of all who rejoice in the spread of civilisation, or take an interest in the progress of Asiatic improvement.

To the kindness of Dr. M'Neil the Council has to acknowledge its obligations for the possession of nine folio volumes, the first of the series issued from the Teherán press. They consist of a well-printed edition of the Korán in Arabic; and of the theological works of Muhammed Bákir, comprising a history of the prophets, from Adam to Muhammed, an account of Muhammed and his companions, and a body of theology, according to the Shiáh doctrines.

Sir George Staunton has presented a large and elaborate model of the pagoda and convent of priests at Canton, which was assigned for the residence of the British ambassadors and their suits in China. Also, an original painting in oil, by a Chinese artist, representing a court of justice held at Canton.

To Sir Henry Willock the Society is indebted for eight casts from the sculptured ruins of Persepolis together with some Babylonian curiosities presented by him in the name of his brother, the late Captain Willock, R. N.

Besides the numerous individuals who have contributed to the library and museum of the Society, the Council is proud to acknowledge the courtesy of the following institutions, in contributing copies of their Transactions—some in exchange for the Transactions of this Society, some altogether gratuitous.

L'Académie Impériale des Sciences de St. Petersbourg ; the Literary Society of Batavia ; the Royal College of Surgeons in London ; the Medico-Botanical Society ; the Society for the Encouragement of Arts, Manufactures, and Commerce ; the Royal Geographical Society ; the Royal Academy of Sciences at Turin ; the Asiatic Society of Bengal ; the Zoological Society of London ; the Royal Society of Edinburgh ; and the American Philosophical Society of Philadelphia.

With the two last-mentioned an arrangement for a mutual exchange of Transactions was entered into during the past year.

In the last Report of the Council, intimation was given of an alteration in the form and plan of the Society's publications ; and the Council is happy to announce, that the change alluded to bids fair to realize every advantage that was anticipated from it, although the Council has not yet been able to carry it to the full extent projected.

On a reference to a comparative statement which has lately been submitted to the Council by the secretary, it will be seen, that a saving of no less a sum than 200*l*. a-year will be effected by this arrangement. But it is not in point of economy alone that the Council bespeaks the Society's approbation in this particular. It finds still higher grounds for congratulation in the fact, that this arrangement has been the medium of placing the Journal within the reach of so much greater a portion of the reading public, and of thus gratifying that increasing desire for information on Oriental subjects which of late, various circumstances have gradually contributed to excite.

From this enlarged sphere of usefulness the Council is tempted to augur, not only increasing support to the Society, but also an addition to the number of labourers in the field of Oriental literature, where, notwithstanding the plentiful harvest which invites them, they have as yet been comparatively few ; that few, however, evincing, it must be confessed, a degree of ardour and devotedness which has rarely been surpassed.

In turning to the operations of the Oriental Translation Fund, the Council has the satisfaction of observing, that they have been carried on during the past year with unabated energy. Several valuable works have been published by it during that period, viz. ; " the Harivansa," a celebrated Sanskrit epic poem, translated into French by M. Langlois ; the " Annals of Japan," edited by M. Klaproth ; a " Description of the Burmese Empire, translated from the Italian MS. of Sangermano by Dr. Tandy ; the " Didascalia," a rare Ethiopic work, translated by Mr. Platt, and to which the original text is added ; a second volume of " Miscellaneous Translations from Oriental Languages ;" and a " History of Guzerat," translated by James Bird, Esq. M.R.A.S. The institution has also many other works of interest in the course of publication.

One of the most gratifying and interesting parts of the Society's proceedings during the past year being, from its recent occurrence, fresh in the memory of every member, the Council does not feel bound, on the present occasion, to do more than merely allude to it. The presentation to Lieut. Alexander Burnes of a diploma, constituting him for life an Honorary Resident Member, in token of the Society's admiration of the zeal, ability, and conduct displayed by that enterprising traveller, as well as of the important services rendered by him to Oriental literature and science by his researches in Central Asia, while it forms a just and appropriate tribute to distinguished merit, cannot, it is hoped, be without its use in stimulating others to a like course of honourable exertion.

Similar considerations to those which prompted the above dispensation, actuated the Society in admitting, as corresponding members,—the Chevalier General Ventura, General Allard, and M. Court, officers in the service of Runjit Singh, for their kind and valuable assistance to Lieut. Burnes, and the late M. Jacquemont, during the sojourn of those travellers in the Punjáb.

In conclusion, the Council has the gratification to observe, that the efforts of the Society have been duly appreciated by, and honoured with the cordial approbation of, learned foreigners; and with this flattering homage it trusts it may combine that of the British public.

It has been said that, notwithstanding our peculiar relations with the East, and with India in particular, the British, of all European nations, have shewn the greatest indifference to subjects in any way connected with Asia, whether of arts, science, or literature. How far this may have been the case is not for your Council to decide; but it feels itself bound to state the conviction, which has arisen from the experience of the past year, that such indifference, if it did once exist, has now given place to a lively interest, and that the proceedings of this Society, its library, and its museum, at this moment excite an attention, which may fairly be considered to have established its title to national popularity.

But your Council is aware, that the aim and object of the Society does not rest here; that it must look to Asia itself, and to India in particular, to form a full and correct judgment of its proper usefulness. And, if we turn to the correspondence at present carrying on with that country, it may, indeed, be matter of proud congratulation to find, that this Society is now looked up to by so many millions of British subjects, distant from us by so many thousands of miles, as the main link that unites them to these realms in the bonds of literature, science, and art.

It is a pleasing duty to your Council thus to point to the proud position the Society now holds, one for which it is alone indebted to the well-judged liberality of the enlightened few, and to that of the Honourable the Court of Directors of the East India Company. Your Council, therefore, now looks for, and trusts the Society will receive some national support; and if, from the judicious application and management of the means that have hitherto been at its disposal, it has attained its present stage of usefulness, we may, it is hoped, from the undiminished favour of its gracious and royal patron, and from the continued liberality of the Honourable Court, expect with confidence, that its exertions will be attended with still happier results, when based on the just and generous feeling of a British public.

From the preceding outline, brief and imperfect as it is, the Council would hope, may be found ample ground of satisfaction with the past career, and sanguine anticipations of the future prosperity of the Royal Asiatic Society.

Sketches of the Meteorology, Geology, Agriculture, Botany, and Zoology, of the Southern Mahratta Country.—By ALEXANDER TURNBULL CHRISTIE, M. D.

(*From the Edinburgh New Philosophical Journal.*)

General Description.—The district of Darwar, in the southern Mahratta country, is of an irregular triangular shape; the apex of the triangle being towards the south, in north latitude 14° 20′, and its base towards the north, on an average, in 16° 23′. Its most westerly point, towards the Goa territory, and which forms one of the angles at the base, is about 74° 5′ east longitude, and its most easterly point, which is the remaining angle, is in east longitude 76° 22′. It is bounded on the north by the Kolapore country, and river Kistnah; on the east by the Hydrabad country, and the Honourable Company's district of Bellary; on the south by Mysore; and on the west by Soondah, (a district of Canara), and by the western gauts, which divide it from the Goa territories. Within these boundaries, besides the British possessions, are many separate tracts, belonging to independent Jagheerdars, and tributary chieftains of different denominations; but so subdivided and varied in their outline, that it would be nearly impossible, and of little use, to give a description of them.

The following observations are not exclusively confined to the Darwar district; but sometimes extend to that of Canara, and to the Portuguese territory of Goa, and thus occasionally embrace the whole tract of country from the Tumboodra to the coast.

The Darwar district is very generally known in India by the name of the Southern Mahratta Dooab; which name it has received, from the circumstance of its extending between the rivers Kistnah and Tumboodra. But this term properly includes the whole tract of country eastward, to the junction of these rivers, and thus embraces a considerable portion of the Nizam's dominions. When this term occurs, therefore, in the course of the following observations, it is to be understood in the above extended sense.

The gauts above Goa, and which form part of the western boundary of the district, have an elevation of 2,500 or 2,600 feet, above the level of the sea, whence the country gradually slopes to the Tumboodra, which is about 1,500 feet above the level of the sea*. In this part of India, there is nothing like mountainous scenery, except immediately under the western face of the gauts; for as soon as you attain their summits in proceeding eastward, you are on the inclined plain which shelves to the eastern coast; and the general declination of which, is only interrupted by gentle hills, which seldom attain a height of above two or three hundred feet.

* The different altitudes which are stated in the following observations, were ascertained by Major Cullen of the Madras Artillery by barometrical measurement.

Immediately to the east of the Gauts, the country continues hilly for about thirty or forty miles; the hills being covered with wood, which becomes gradually thinner, and more stunted, towards the east. Beyond this hilly tract, as far as the eastern frontier of the district, the country consists of extensive plains, intersected in different places by long narrow ranges of sandstone hills, with even summits.

This particular configuration of the country, gives rise to striking peculiarities in its climate; and, consequently, in the vegetable and animal productions of its different parts. This circumstance renders it susceptible of a very natural division into three distinct parts; viz. into the western or hilly part, the plains which occupy all the central and eastern parts of the district, and the ranges of sandstone hills, which intersect these plains.

The summits and western face of the gauts afford, in many places, the most savage, and, at the same time, beautiful scenery. A boundless forest of gigantic trees, with the utmost variety of foliage, covers the highest hills, and penetrates into the deepest recesses of the valleys. In some places, enormous masses of black rock, which appear to have been rent from the neighbouring hills, rise high over the tops of the woods, and form a fine contrast to the rich green of the surrounding foliage. Wherever the forest opens a little, so as to admit of the growth of humbler plants, the ground is covered with the most luxuriant grasses, and flowers of the richest hues. The stillness of this wilderness is only interrupted by the sleepy sound of a mountain stream, or occasionally by the harsh cry of some solitary birds, or the loud hollow voice of a monkey. Animals are seldom met with; and often on your journey, nothing is to be seen for hours but an endless luxuriant vegetation.

Some very beautiful waterfalls are met with in the western gauts, but many of these are completely dried up in the hot season. There are very fine falls in the gauts above Honoor, which, for sublimity and magnitude, will probably yield to few in the world. They have hitherto been little known even to Europeans in India; and it is, I believe, only within the last ten or twelve years that they have received a name. They are situated on the river Shervutty, about fifteen miles up the gauts, from the town of Garsipa. They are now known to Europeans by the name of the Falls of Garsipa. I visited them in the month of October 1825.

The country in the neighbourbood of the Falls is extremely beautiful, combining the mjaestic appearance of a tropical forest with the softer characters of an English park. Hill and dale are covered with a soft green, which is finely contrasted with a dark forest, with numerous clumps of majestic trees, and thickets of acacias, the carunda, and other flowering shrubs.

Upon approaching the Falls, you emerge from a thick wood, and

come suddenly upon the river, gliding gently among confused masses of rock. A few steps more, over huge blocks of granite, bring you to the brink of a fearful chasm, rocky, bare, and black; down into which you look to the depth of a thousand feet! Over its sides rush the different branches of the river, the largest stretching in one huge curling pillar of white foam, without interruption to the bottom. The waters are, at the bottom, by the force of their fall, projected far out in straight lines; and at some distance below the falls, form a thin cloud of white vapour, which rises high above the surrounding forest. The sides of the chasm are formed by slanting strata of rock, the regularity of which forms a striking contrast to the disorder of the tumultuous waters, the broken detached masses of stone, and the soft tint of the crowning woods.

The effect of all these objects rushing at once upon the sight, is awfully sublime. The spectator is generally forced to retire after the first view of them, in order gradually to familiarize himself with their features; for the feeling which he experiences upon their sudden contemplation, amounts almost to pain. After their first impression has somewhat subsided, and he has become accustomed to their view, he can then leisurely analyze their parts, and become acquainted with their details.

The chasm is somewhat of an elliptical form. At its narrowest and deepest part is the principal fall; and over its sides smaller branches of the river and little rills are precipitated, and are almost all dissipated in spray before they reach the bottom. The principal branch of the river is much contracted in breadth, before it reaches the brink of the precipice, where it probably does not exceed fifty or sixty feet, but it contains a very large body of water.

The falls can only be seen from above, for the precipices, on both sides of the river, afford no path to admit of a descent. Some gentlemen have attempted to reach the bottom by having themselves lowered by ropes; but no one, to my knowledge, has hitherto succeeded. A view of the fall from below would, I am convinced, exceed in grandeur every thing of the kind in the world. The spectator can very easily, and with great safety, look down into the chasm to its very bottom. Some large plates of gneiss project, in an inclined position, from its edge; so that by laying himself flat upon one of these, he can stretch his head, considerably beyond the brink of the precipice.

No accurate measurement has yet been made of the height of these falls. Some who have seen them declare, that their height reaches at least 1,100 feet: others that it does not reach 1,000. I prepared a rope 900 feet long, attached a stone to one end of it, and let it slip over the edge of a rock, which projects several feet beyond the side of the precipice. When 500 feet of rope had been let out, the stone was forcibly drawn towards the principal cascade, which soon involved it

among its waters, and snapped the rope. The stone at this time appeared to be about 200 feet from a small ledge of rock, which might be between 200 and 300 feet from the bottom. It is not improbable, therefore, that the height of the fall is not much short of 1,000 feet.

We shall now return to the description of the Darwar district. It has been stated above, that it may be divided into three parts, viz. the western or hilly parts; the great plains in the central and eastern parts of the district; and the sandstone hills which intersect these plains.

The boundary between the plains and hilly tract is very irregular. Proceeding from the east, a few insulated low ranges are first met with, having a general direction of north-west and south-east. The hills continue in parallel ranges with the same direction, for many miles to the westward. But when within six or eight miles of the summit of the gauts, the scenery assumes a more irregular character, the hills being heaped more together, with steeper sides, and more irregular forms. The rugged and wild features of mountainous scenery are no where met with; for the hills are generally somewhat rounded, are softened with a rich vegetation, and resemble, in their general character, the hills of Cumberland, or those between Geneva and Lyons.

The second division, or the plains in the central and eastern parts of the district, are precisely similar to the extensive plains of cotton ground met with in every part of India. They are almost entirely in a state of cultivation. During the rainy and cold seasons they are covered with luxuriant crops. The regularity in which these are planted; the great variety of colours produced by the numerous kinds of grains, pulses, oil and cotton plants, and the great extent over which they are spread, afford an appearance of riches and prosperity. In the hot months the scene is entirely changed; you then look around on the arid plain, whose deep black soil is every where intersected by wide fissures. Not a patch of verdure, not a tree or shurb, is to be seen. Clouds of dust are swept along by the parching wind, or huge pillars of it, raised up by whirlwinds to the height of a hundred feet, are seen stalking across the plain; or (if the atmosphere be calm) fixed for a length of time to one spot. This cheerless view is only terminated at a distance by a line of sandstone hills, whose even summits give them the appearance of a great wall. The sun, now nearly vertical, produces a painful glare, and every living thing is overcome by the oppressive heat, not even the hum of an insect being heard.

The sandstone tract occupies all the northern parts of the district. It commences to the east of Gudjunderghur; whence it extends north to the Kistnah. Its southern boundary runs from Gudjunderghur through Julleal and Konoor to Pursghur; whence this tract extends, with some interruptions, north to the Kistnah, and north-west to

Gokauk, Padshapore, and into the Kolapore country. Within this tract, however, are many extensive plains of cotton ground. The sandstone hills are invariably in long ranges, the general direction of which appears to be north-west and south-east. Many of the valleys between these ranges possess a soil of pure sand, the debris of the neighbouring hills. The hills are generally bare; and where they possess a slight covering of soil; produce only a few stunted shrubs, consisting principally of cacti, mimosas, and the cassia auriculata.

Another range of hills of much less extent than the sandstone hills, and which could not be included in any of the above divisions, deserves to be noticed in the physical geography of the district. It is called the Kupput-Good-Range. It consists of granite and schists; and extends from near Guduk, in a south-east direction, as far as the Tumboodra. Were it not for this range of hills, the cotton ground plains would extend uninterruptedly from the southern extremity of the district to Gudjunderghur and Konoor.

Five rivers water this district, viz. the Kistnah, the Tumboodra, the Gutpurba, the Mulpurbah, and the Wurdah. The two first are by far the most considerable, and form the northern and southern boundaries of the district. The three others are reduced to comparatively small streams in the hot season. They all take their rise in the western gauts. Besides these, there are numerous streams, or nullahs, as they are called, the most considerable of which is the Beyny nullah, which has its source among the hills in the neighbourhood of Miscrecottah, flows northward through the black plains, and falls into the Mulpurbah. Most of these nullahs are dried up in the hot season.

These rivers and nullahs, except in the western parts, are devoid of beauty; being sluggish and muddy. They cut their way through the deep cotton ground, which, in the dry season, forms precipitous banks, deep, black, and bare; and thus, in many places, the river has more the appearance of a great artificial ditch, than of a natural stream. The banks, which in many places are from twenty to thirty feet deep, are often overflowed during the rains. Nowhere are to be seen the sloping banks covered with verdure, with trees and flowers, which make the river scenery so beautiful in temperate climates.

Meteorology.—The most opposite climates are met with in different parts of the southern Mahratta country; for the western parts, towards the gauts, may be reckoned among the wettest parts of the Indian peninsula, and the eastern among the driest. The average quantity of rain in the latter may be reckoned at from 20 to 25 inches; in the former, a larger quantity than this often falls within one month*. The climate becomes gradually drier as we proceed eastward, from the chain of the western gauts; and as this chain runs N. NW. and S. SE. We have consequently a drier climate in the northern part of the district,

* Vide Statistical Report of part of the Southern Mahratta Country, by the late Dr. Marshall.

than in the southern, on the same meridian. Thus, at Soondah, the climate is rainy and cool; at Gokauk, on the other hand, which is in the same longitude, it is dry and hot.

A considerable quantity of rain falls as far eastward as the country continues hilly, but beyond this the supply is scanty and precarious. In August 1824, a good deal of rain fell at Darwar; while at the same time, not a drop had fallen fifteen miles to the east, and the wells there were nearly dried up. For three weeks in July and August this year (1827), nearly incessant rain fell at Darwar; and during the same time, not a drop fell in the eastern parts of the district.

The difference in the habits and mode of life of the inhabitants of the western and eastern parts of the district, abundantly testifies how very opposite are their respective climates. In many places, the former are often for weeks during the monsoon confined to their own villages or huts, not only by the severity of the rains, but in many instances by the stoppage of their communication by the swollen nullahs. During this dreary period, (in anticipation of which a stock of provisions is always laid in as a ship is supplied for a voyage), the inhabitants sit round a fire in the centre of their miserable dwellings, which are thus constantly filled with smoke. When they do venture out in this weather, they wrap themselves in a cumly* and over this they place "a sort of thatched case or shell, made of the leaves of the jar†, or some other of the palm tribe. It is broad over the whole back and shoulders, narrowing to a peak immediately over the head, and coming down the front over the face, just so far as is necessary to give it a firm hold, with a slope sufficient to carry the water that falls on it clear of the body ‡."

In the eastern parts, it is very different. The rain is seldom so severe as to prevent the inhabitants from going out for four and twenty hours at one time:—and there, precautions against heat, not against cold, are necessary.

The villages in the western parts consist of thatched huts, whose steep sloping roofs nearly reach the ground, the walls being only a few feet high, that they may be effectually protected from the rain. Every spot is covered with vegetation. Hedges and trees covered with twining plants line the roads, and the thatched roofs are often concealed by creepers, generally cucumbers, pumpkins, &c.

The villages in the eastern parts present a curious contrast to the above. Generally not a spot of green, for many months in the year, relieves the horrid glare. All is parched and brown. No protection being required against heavy rain, the houses are built entirely of clay, which one heavy shower, such as the western inhabitants constantly experience, would completely level to the ground. The walls of the houses are formed of sun-baked clay, and are from eight to ten

* A native blanket. † Borassus flabelliformis. ‡ Marshall, op. citat.

feet high. Upon these is supported a terrace roof, composed of branches of trees or bamboos, covered with clay. Nothing can be conceived more ugly than these villages. On every side square masses of dry clay, give one more the idea of huge ant-hills than of human habitations. In these places, wood being found in too small quantity to serve as fuel, cow-dung is used for this purpose ; which being made into small cakes, is thus plastered on the walls of the houses to dry in the sun. When dry, it is collected into stacks, like peat-stacks in a Scotch village.

Darwar, which is situated on the eastern edge of the hilly tract, enjoys a tolerably cool and agreeable climate. The only time at which the heat is very oppressive is in March, April, and part of May; and even then a cool refreshing westerly breeze sets in every afternoon, and continues during the whole night. The luxury of this breeze is duly appreciated by those who come from the interior, or from the eastern or western coast, where the nights, during the hot season, are close and oppressive, preventing sound sleep from refreshing the languid frame, overcome by the heat of the day. This cool breeze is felt but a very short way to the east of Darwar, for it soon becomes heated, by passing over the arid plains of that part of the country.

Speaking generally, it may be said, that, at Darwar, as in other parts of India, the wind blows during six months, viz. from the middle of April to the middle of October, from the south-west, and during the remaining months from the north-east. But it has been already mentioned, that, during the hot months, a cool wind blows all night from the west; and it must be added, that, for several weeks, at both equinoxes, the wind is variable.

Heavy thunder-showers fall at Darwar in April and May. The weather then continues cloudy, and the steady rain of the monsoon generally begins in June or the beginning of July. It is a curious circumstance, that the first heavy showers that fall do not come from the west, but are accompanied by the following phenomena. During the day the wind blows steadily from the south-west. Between three and five in the afternoon, black clouds are seen accumulating in the east. Cloud rises over cloud, until the whole eastern sky is covered with one dense black mass, which, now pierced every where by forked lightning, and accompanied by constant peals of thunder, slowly approaches against the western breeze. When it has approached very near, the wind suddenly changes, blows strongly from the east, and brings along with it heavy battering rain, and sometimes large hail. The wind changes frequently, blowing from all quarters of the compass, until at length it becomes steady from the west, and the tempest ceases. This is repeated every day for some days, after which the wind continues to blow constantly from the west for five or six months. Storms also occur at the autumnal equinox, but not so regularly nor so violently as those first described. Although there is a good

deal of rainy weather at Darwar, yet there are seldom such deluges of rain as frequently occur on the coasts; and the total annual quantity of rain is certainly less than that which falls either on the western coast or on the Gauts.

It is a curious circumstance, that, while a cool breeze blows during the nights of the hot months in the southern Mahratta country, there is often at the same time a most perfect calm on the western coast: proving that this is not a sea-breeze, as supposed by many. It is probably owing to the peculiar surface of the country, and produced in the following manner. The gauts and western parts of the country being covered with wood, and more plentifully supplied with moisture than the interior, must consequently be always cooler; but more especially at night, for the arid plains retain the heat of the day longer than the moist woods. The hot air of the interior, therefore, will ascend, and be replaced by the cool air from the western jungles, and thus give rise to a refreshing breeze, which will continue all night, and as long as it is not counteracted by the prevalent north-east wind, which, being always more powerful during the heat of the day, then gains the ascendancy. Now, as the western parts of the country are 2,500 feet above the western coast, the wind which blows over them does not ascend from the coast below, for it has been already stated that the atmosphere on the coast continues calm: it must therefore be supplied from the same altitude; and we may accordingly conclude, that a mass of air above 2,000 feet in height rests undisturbed on the coast, while that immediately above it, viz. on a level with the summit of the gauts, is in rapid motion towards the interior.

The following remarkable and interesting appearances, which I observed at Goa on the 6th of October last year, show, in a striking manner, what a great influence the gauts have on the meteorological phenomena of this part of India, and also confirm the above observations regarding the western breezes of the southern Mahratta country. Large masses of clouds, with lightening and thunder, were observed on the gauts about mid-day. The clouds gradually proceeded westward, but at a very great altitude; and, in the evening, they completely concealed the blue sky, stretching far to the west over the sea. The air below continued close and oppressive, and thunder was heard, high over our head, among the clouds that had proceeded from the gauts. Thus the air, resting on the low country, continuing undisturbed, while great hygrometric and electric changes occurred in the atmosphere, only on a level with the summit of the gauts.

Fogs in the morning are very common at Darwar, and often present a very remarkable appearance. They invariably proceed from the west, and, about sun-rise, are seen rolling, in dense masses, over the hills. They sometimes appear black, at other times perfectly white, according to the spectator's situation in respect to the light. They are generally not very high, and vary much in their form and

extent; sometimes covering a great tract of country, at other times being very partial, and stretching out, as it were, into long bands. When riding out in the morning, I have frequently observed a thick mass of fog on each side of me, while the intermediate space was clear; one of the masses having a black, the other a white colour, arising from their different situation in regard to the rising sun. These fogs never last longer than a few hours.

The mean temperature of the first ten months of 1827 was 75.212, and of spring-water 75.635. This will probably be a little too high for the mean of the whole year; for November and December are among the coolest of the twelve months: 75 therefore is, perhaps, a very near approximation to the true mean temperatnre of Darwar. The total quantity of rain which fell, from the commencement of the rains in April up to November, was $26\frac{1}{16}$ inches. The rain which fell in January, was quite unusual, and, indeed, such a circumstance was not remembered by the oldest inhabitant to have ever happened before. A few showers sometimes fall in November and December, but never any heavy rains. The supply of rain at Darwar, in 1827, was considerably less than usual.

Belgaum, which is the military head quarters of the division, has a much cooler climate, and a much larger supply of rain than Darwar, owing to its vicinity to the gauts.

The mean temperature of Darwar is probably about ten degrees below that of Madras.

(To be continued.)

*** We thought we could not do a more acceptable service to our readers than thus to re-print the valuable and interesting papers of Dr. Turnbull Christie, the existence of which is hardly known in this country, from their never having been published in any Journal having a very extended Indian circulation. While contributing in this manner to the interest of our pages, we are, at the same time, paying a very appropriate tribute of respect to the memory of a distinguished scientific member of the Madras service, by inserting his productions in the Literary Journal of the Presidency to which he belonged—that so his name may live in lasting remembrance amongst us, and others may be excited to emulate his example, in making observations of a similar nature in the districts wherein they are located. For this latter purpose we take the liberty of pointing out Dr. Christie's papers as models for the essays of those who are so kind as to contribute information of this nature to our pages—particularly to our medical readers, from whom such observations would come most appropriately, describing, as they do, the medical topography of countries, a knowledge of which is so necessary to a right understanding of the origin and nature of diseases, as well as of their counteraction, or prevention, in very many instances.—*Editor Madras Journal.*

Notes explanatory of a Collection of Geological Specimens from the Country between Hyderabad and Nágpur. By J. G. MALCOLMSON, *Assistant Surgeon, Madras Establishment.*

(From the Journal of the Asiatic Society of Bengal, No. 50*).*

I had the pleasure of forwarding from Madras, a selection of geological specimens, collected in May, 1833, between the cities of Hyderabad and Nágpur. I regret, that circumstances prevented my doing this sooner, and that the notes in explanation of the localities whence they were obtained, must now be short and imperfect; I hope, however, that the specimens themselves will be of use in illustrating the geology of a tract of country hitherto undescribed, and which connects the formations of the south-east of the Deccan, with those in the neighbourhood of the valley of the Narbada.

From my inability to indentify, describe, and figure the numerous fossils, discovered in the tract of country between the Godavery and the town of Hinganghát, 47 miles south of Nágpur, and the importance of these, in reference to the questions as to the relative age of the great trap formation of the Deccan, and of the west of India, and the clayslate formation of VOYSEY, with its associated sandstone*, and the periods of elevation of the granitic rocks, on which they appear universally to rest; I am induced, contrary to my former intention, to take to England with me, those specimens of which there are no duplicates. The separation of the collection would greatly lessen its value, by depriving me of the opportunity of comparing, with each other, and with arranged collections, the fragments of those of which duplicates were not preserved, and of thus restoring the fossils of which no perfect specimen was found. A selection of the most perfect were, also, sent to Mr. LYELL, but as he considers it requisite that numerous species should be ascertained previous to arriving at any conclusion as to the age of the fossiliferous rocks, it may be for the advantage of Indian geology, to submit the rest of the specimens to him; and on the characters being determined, to return a portion of them to India. There are, however, a sufficient number of duplicates to illustrate the outlines of the geology of the interesting tract of country referred to, and to connect the singular phenomena observed, with others, to the west and east of the route, and in the countries of the peninsula to the south, and the Bengal provinces to the north. The outline map includes several places, inserted in the plans published along with Dr. VOYSEY's papers and Captain JENKIN's Account of the Mineralogy of Nágpur, p. 199, of the 18th volume of the Asiatic Researches; the interval between which, it will assist in

* See his account of the diamond mines of Banganapilly.—As. Res. xviii.

Vindyah Mts
Narnulla
Gawulgur
Ellichapoor
Wurdah R.
Ramteak
Kamptee
NAGPOOR
Seetabuldee
Poornah R.
Oomrawutty
Goomgaum
Takulghaut
Sindee
Ackolah
Mahandgaum
Hingonghaut
Naugree
Chiknee
Wurroonah
Kurinjah
Payne Gunga R.
Baussum
Pandeseourah
Bandack
Chandah
Lonar
Richwar
Mahoor
Kair
Rajoorah
Sangaree
Tulnee
Poornah R.
Hingole
Tutny
Idulabad
Chichely
Ahoondah
Doodnah R.
Oomerkeer
Echode
Sirpoor
Mundwah
Wurhonah
Buswunt
Kurrum R.
Bibbe...
Nandair
Audkere
Godavery R.
Apparowpet
Nirmul
Doodgaum
Soorarum
Kair
Colapilly
Sironcha
Balcondah
Mahadeopoor
Indoor
Hurroolah
Chinnoor
Ramgheer
Lankulagudda
Perriapoor
Dekarapully
Elgundel
Mullangoor
Manjerah R.
Oodgheer
Mulloopetta
Nuggur
Nagarum
Mungapett
Owsah
Kamareddypett
Bekanoorpella
Rungapoor
Rajampella
Byarum
Maiduck
Beder
Narsingumpell
Warungole
Byorah or Bougah
Munnugoor
Ashwapoorum
Doopranee
Badrachellun
Yellumpettah
Naganellypett
Godavery R.
Ahmedhal
Boughcer
Palensha
Gopaulrowpett
Bolarum
Secunderabad
HYDERABAD
Gungarum
Culburgah
Dummapait
Cummamet
Shumshabad
Nelgondah
Sooriapett
Chintalapoody
Gokarum
Rajahmundry
Ramsingarum
Juddacherlah
Ellore
Dewurcaudry
Warrapilly Gt
Condapilly
Yeedagherry
Beemah R.
Bexwarrah
Maddapollam
Muctul
Paungul
Ruckpullypett
Kistnah R.
Rauchoor
Pentelly
Masulipatam
1 Fossils
2 Granite & Mica Slate
3 Sandstone
4 Granite
5 Basalt
6 Fossils in Lime on Granite
7 Fossilwood
8 Blue Lime Stone
9 Fossilwood silicified. 1828.
10 Clay Slate
11 Marine Fossils on Basalt in Lime. As. Jour. Aug. 1835
12 Iron Mines
13 Red Iron ore used here (See Ayin Akbery)
calcareous conglomerate.
15 Lake Crater 6 Miles in circumference and 500 feet deep.
* Basalt Hill.
* * * * Basaltic Hills probably connected with those near Beder & Meoondah. As. Jour.
16 Hot Springs.
76°
78°
80°
82°
18°
20°

BRITISH MUSEUM NATURAL HISTORY.

filling up. I shall seldom use mineralogical terms, except I have had an opportunity of comparing the specimens with those collected by persons well acquainted with the science; and when they do occur, an examination of the specimens will afford the means of correcting any errors that may be fallen into. The geological relations of the strata were ascertained with as much care as the nature of the country permitted, and no exertion was spared in tracing them as far as possible, both on the plains, at the foot of the hills, and their most inaccessible summits. My avocations however were unfavourable, and a person more at leisure would find an ample field to reward his labours. He must, however, be prepared to pursue his examinations in the height of the hot season, when the grass and wood jungle are less luxuriant, and the plains free from their covering of *jawárí* and other grain.

Some account has already been published* of the country between Masulipatam and Hyderabad, on which I had not an opportunity of making many observations. One or two points, however, deserve to be noticed, as the specimens collected in this part of the route are similar to those found north of Hyderabad, as far as Nírmal, and throw some light on appearances on which important inferences have been too hastily founded.

At page 70, vol. ii. of the Gleanings in Science, a desire is expressed by a gentleman at home, stated to be of high scientific acquirements, that specimens should be collected from the face of the hill of Bezwarah, where it has been cut through by the *Kistnah* river; and the author of the queries, seems to be impressed with a belief, that a lake had formerly existed some way above it, towards Warapilly. The distance, however, between the Warapilly ghat and Bezwarah, is considerable; and I do not think, that there are any decided appearances at the former of the blue limestone of the clay-slate formation† having constituted the margin of a lake. The strata at the upper part of the rising ground to the north of the river are as hard as those lower in the valley, or on the opposite bank. A specimen of this rock, of a pure white colour, and of great hardness, which I broke from the summit of the ascent above Warapilly, well known to travellers from the difficulty of riding over the large smooth slabs of marble, and which would have been admirably adapted for lithographic purposes, had it been free from minute crystals of quartz, was sent to you about three years ago by Captain Smith of the Madras Engineers. The junction of this rock with the granite to the north, could not be

* Asiatic Researches, vol. xviii.

† I use this term of Dr. Voysey, but think its adoption more objectionable than argillaceous limestone, used by Colonel Cullen in the Madras Transactions. It would be better to characterise it as "blue limestone," "Cuddapah limestone," or other term involving no opinion as to its geological relations.

seen, the country being flat, and covered with low jungle. Jaspers and fragments of trap are found in the bed of the river, and the granite to the north is intersected by numerous dykes of greenstone, usually running from S. E. by E. to N. W. by W. To the south of the river, the country is lower, and for some way beyond the town of Dachapilly, the limestone, usually dipping slightly to the south, continues to be the surface rock; which, whenever I have met with it, on the Kistnah, at Cuddapah, near Auk, and the diamond mines of Banganapilly, and at Tarputri in Bellary, or in the neighbourhood of the Wurdah, affords the best indications of success to experiments in boring; copious springs spontaneously rising from it, or being lost in the interstices between its nearly horizontal strata.

At Bezwarah, the river Kistnah appears to have cut a channel through the short ridge of hills, which terminates on either side in rather precipitous cliffs, and admits the stream into the great alluvial plains extending to the mouths of the Kistnah and Godavery. Above, the country has much the appearance of having once been an extensive lake, the bottom of which now forms the rich plain extending to Condapilly to the N. W., and Munglegherry to the south of the river. It is probably here, that Captain Herbert's correspondent observed that the " hardness and composition of the rock appeared to differ, according to the pressure they have been subjected to." I believe, that, specimens of the rocks of the bottom of the hill, have been sent to the Asiatic Society by Dr. Benza, and that they are composed of the peculiar gneiss of the coast. Felspar is common, and some of the varieties possess considerable beauty. There are the remains of a rock pagoda cut in a mass of compact felspar, above the road, leading along the edge of the precipice over the river, portions of which have fallen, the natural fissures of the rock exposing it to this kind of decay. On the top of the hill the soft friable white rock, is found, and is carried away by the natives for the purpose of whitening the walls of their houses. It corresponds exactly with specimens from Vizagapatam, described as gneiss by Heyne, and containing imperfect garnets. It is not, however, either its site as lying above other rocks, or its exposed situation, that has led to its decay, so much as the composition of the ridge where the edges of the strata rise to the south. The strata dip at a very considerable angle a little to the south of east. A careful survey of the hills from the summit shows, that they are short insulated ranges, such as are found over the Circars and other tracts, rising from a level country; and that had a lake existed in the plain above, every slight rise of the river would have carried its waters round their shoulders to the north and south. The rise in the line of bearing of the strata of the hill north of the river, and the appearance

of that to the south, do not support the opinion that the lake was drained by the river deepening its channel. I do not know whether it can be supposed to derive any support from a tale told of the river god *(Krishna)* having induced the patron of the hill, who seems to be a form of *Shiva*, to permit him to get his head through, and that then he forced a passage. The granitic hills of Condapilly are seen a few miles to the N. W.; and in the midst of the plain, rising out of it like an island, are some great masses of hornblende rock; and Dr. Benza informs me that he saw dykes of the same kind of greenstone passing through the gneiss at Bezwarah. A mile and a half further on the road to Hyderabad is a quarry of granitic rock, devoid of hornblende, and containing only a very little felspar and a few scattered garnets. A little beyond this, the rocks assume the decided characters of the great granite formation of the Deccan, with which Dr. Voysey's papers have made your readers acquainted. The geological structure of the Circars is in nothing so peculiar, as in the extensive distribution of the singular sandstone-like gneiss described by Heyne; and which, in hand specimens, it is often impossible to distinguish from the sandstone also found in many localities: and I do not know a more interesting subject of inquiry, than that of ascertaining whether this singular rock is metamorphic, and the sandstone altered by the intrusion of the great masses of prophyry so commonly found near these equivocal rocks, and by the numerous greenstone dykes and masses scattered over the whole of these districts. The diamond mines of Mulavelly are at no great distance from Condapilly, to the right of the road, situated in a basin between hills covered with jungle. The sides of which, one-third from the top, were found by Dr. W. Davidson to be strewed with a sandstone conglomerate; but he was prevented getting to the top by the approach of night. Fragments of this are found in the gravel, of which I believe specimens have already been sent to the Society, intermixed with much kankar; and from some pits in the valley, most of the lime used in the district is procured. The soil of the country on the Hyderabad Military road, after leaving the alluvial plain above Bezwarah, is formed of decomposed granite, but contains much lime. This admixture, and the kankar nodules are probably of recent origin; as I observed, in a valley to the right of the road north of the hill fort of Yeralagundah, about 18 miles from Bezwarah, a stream trickling over granite rocks, and depositing lime on all the branches and rocks around. Some pieces of stone of considerable size have thus been formed, and recent specimens, containing remains of branches, or of grass, easily crumble to pieces, and are carried away by the stream. The source of the spring I was prevented from ascertaining, by the approach of night; and as an excuse for leaving this and other interesting circumstances unexplored, I

must state, that being in Medical charge of the European regiment, during a sickly season, I could not command my own time of marching, or sufficient leisure.

The character of the granite of the Deccan continues well marked throughout the remaining part of the route to Hyderabad, and dykes and imbedded masses of a fine crystalline greenstone or hornblende rock of great hardness are frequently seen. These last have occasionally irregular shapes, and in one or two instances, that of the italic or other irregular curve; and near Secunderabad, they appear to be connected with the dykes, in the neighbourhood of which they are found. It was also frequently observed that the various substances entering into the composition of the granite in the neighbourhood of these dykes or masses, formed very large and distinct crystals; and the imbedded greenstone, though often intimately united with the granite, was in others more loosely connected, and easily separated by the progress of decomposition, leaving rounded cavities in the rock.

A circumstance of more importance, however, is the occurrence of the beds of kankar in this tract, being, as far as I have observed, always near some of the greenstone dykes or beds, and frequently under or intermingled with masses of granite, which is in a rapid state of decay: these are usually rounded, partly from the progress of decomposition, and sometimes from the tendency to concentric forms, which it occasionally undoubtedly assumes. The small detritus is in some places accumulated to a great depth, and it has been stated by Dr. Christie, that this debris is, at a considerable depth, a gain consolidated by pressure. In the Edinburgh Journal of Science, 1828-29, this is also mentioned as a fact, common to the rocks of other parts of India. With every respect for his authority, I cannot avoid the conviction, that the inference was founded on imperfect observation, and that it has since been employed in Europe, in support of an ill-founded theory.

The "Mhurrum" or gravel found in deepening a well at Bolaram, (six miles from Secunderabad), upwards of 50 feet deep, during the very dry season of 1832, and is not in the slightest degree consolidated. A loose block, which had resisted decomposition, was found above it, and contains mica, a rare ingredient in the granite of Hyderabad. Much of the debris at Secunderabad is, however, consolidated by lime, which is seen to agglutinate the fragments, or to pass in vein-like lines or nodules through the gravel. Occasionally there are only a few fragments of quartz or felspar scattered through the kankar, or they appear to be inserted into the surface, which is extremely hard. Generally, however, the agglutinated gravel is friable, and the cement less obvious. The debris is also sometimes united into pulverulent masses, by the oxidation of the

iron contained in the sienite; but this takes place at the surface, and seldom acquires any great degree of hardness. Specimens of the granite in the neighbourhood of Hyderabad are numbered 14; and the appearance of the surface of that polished by the continual passage of hyenas, in the entrance of the caverns formed in the pile of gneiss or granite of the "Chìtá hill," near the cantonment, has been described in the 1st volume of the Journal of the Asiatic Society. The greenstone occasionally has distinct crystals of felspar scattered through it, without the porphyry thus formed, losing the remarkable degree of toughness possessed by the black rock; but, as observed by Sir H. Davy, the decomposition of the felspar is more rapid than of the other parts. The greenstone is familiarly known by the name of "black granite," and forms, when finely polished, the beautiful tombstones of the Golconda mausoleums, and the pillars of that in which Hyder and Tippu Sultan are deposited, at Seringapatam. The remarkable quartz veins in the neighbourhood of Hyderabad have been described by Voysey and Christie; it is therefore only necessary to mention, that they occasionally exhibit a more or less regular crystallization, and at the same time, acquire the fine tints of the amethyst. It is seldom that they are sufficiently regular and perfect for the purposes of the lapidary; such specimens were, however, discovered a few years ago, close to the European barracks, and at a little distance from a great greenstone dyke, but not in direct contact with the quartz bed containing the crystals, which, on the contrary, passes into the ordinary sienitic granite of the country. The colour of the amethystine quartz seems to be derived from magnetic iron ore, which is disseminated in grains both through the milky quartz and the granite, amongst which they are found, and has not been noticed elsewhere in the neighbourhood. The amethystine quartz was again met with 60 miles north of Secunderabad, near Bekanúrpettah, in loose masses, along with that variety of laterite found near Beder, and described by Voysey, and which is seen along the coasts of Malabar and at Boranghur in the Southern Concan resting on basalt. The rising ground on which they were found is composed of granite; but the country around is of a black trap soil, and numerous low flat ranges of basaltic hills are seen to the north, the east, and the west. A vein of white quartz is also met with as at Secunderabad, but the specimens differ, in containing irregular shaped geodes of agate, lined with crystals, or a red opake mamillary quartz, approaching to calcedony. The iron in these is usually imperfectly mixed with the quartz, and from the appearances above described, and the quartz having in several specimens been changed into a red jasper, the surrounding trap may be supposed to have altered the rocks. The colouring matter seems to have been afforded by the laterite, which is found in the neighbour-

hood apparently in dykes, and in contact with the quartz which intersects the granite: but there being no section, and the water-worn surface only being visible, no evidence could here be obtained, in support of any of the opinions entertained by geologists, relative to this singular formation. The amethysts are also found south of Janganapilly, and at Kamareddypettah, and Mr. W. Geddes met with them, of a greenish yellow tinge, south of Balcondah.

Granite Tract between Hyderabad and the Nírmul Hills.—The valleys and some plains about Bekanúrpettah are composed of black soil, mixed with calcedonies, &c.; and to the west of the road are some flat hills, which I had not an opportunity of examining. They corresponded in their steep sides and flat summits with the trap hills to be presently described, and Mr. Geddes informed me, that they are formed of amygdaloidal trap, based on decaying granite. With these interruptions, the granite continues to Kamareddypettah, but the mamillary eminences, and the tors and loggings stones formed from their decomposition, are of more rare occurrence. The granite, however, still continues to exhibit the lamellar structure, and is easily split into large slabs. In some instances, where the lamellæ are thin, the vertical fissures which frequently intersects them in right lines, and greatly assist the progress of decomposition, cause the rock to break into regular rhomboids. The last "tor stones" observed on the road to Nágpur were north of Jakrampilly, where they occurred on a lofty hill, on which there is a small pagoda. After leaving the basaltic hills near Bekanúrpettah and Jungampilly, black soil is seen in the valley below a large tank, and some dykes of greenstone pass the road in the direction of S. by E. to N. by W. at Kamareddypettah; the granite is lamellar white, with black mica and some hornblende, and fragments of amethystine quartz are scattered about. A little to the north of the town, on ascending a very gentle ascent, the red soil and granite give way to black soil, derived from decomposed trap rock, which is concentric on the top, but lower down is arranged in imperfect strata. On descending the hill to the north, the black soils conceals the granite for a short distance; but at the bottom of the hill, and in the bed of a small water-course, it is seen of the same appearance as before. Immediately beyond this, there is a very remarkable hill, which is seen from a considerable distance standing out from the gently indulating country, and possessing the peculiar form of the trap hills of the Deccan; it lies five miles north of Kamareddypettah, and four miles south of the village of Nugger. On approaching it by a very gradual ascent, the soil changes to black; and all at once the hill rises with nearly perpendicular sides, constituting a narrow ridge, about half a mile in

length, and of a shape approaching to that of an italic *f* running nearly N. by E. to S. by W. The hill is entirely formed of basalt, as its form had led me to expect. Above and in the body of the hill it has a concentric globular structure, the external layers of which are remarkably soft, and on the top of the hill resemble a peperino; lower down it is soft, of a greenish colour, and soapy feel. The nuclei left undecayed on the top, are exceedingly hard and tough, of a deep black colour, and contain large crystals of olivine, and small globules of calcedony. Many small but very characteristic specimens of this last mentioned mineral, which had been imbedded between the concentric nodules, were picked up. At the bottom of the hill, the basalt loses its concentric form, and occurs in tables or laminæ, having the appearance of having been subjected to violent forces. It sounds under the hammer when struck. Various specimens of the trap are much loaded with iron, sometimes in grains of a reddish brown colour; at others, it appears as if it had been partially smelted, and is not very different in its appearance from some examples of laterite. Much of the "kankar" that abounds in the soil is coloured with iron, while other portions are perfectly white; it is not, however, confined to the soil, as it was observed to have formed between two laminæ of the basalt, and by the gradual deposition of the lime, to have nearly broken up the upper stratum. From between some of the vertical fissures in the tables, and round the large rounded masses that occur in them, a formation of "kankar" projects in several places half a foot from the surface of the rock. It was evident, that the water loaded with lime, percolating through the alluvial black soil, or through the rock itself, gradually deposits the earth, where its accumulation is favoured by circumstances, of which the most important is the occurrence of an impervious rock or soil below that supplying the lime; and this explains the absence of organic remains in this recent formation, except where, in soils rich in lime, it forms round the roots of plants, and unites with itself, here and there, a fresh-water shell. The rock over which the river flows is granite, intersected by some great dykes of greenstone, whose surface has a smooth metallic coating where washed by the stream. They project eight or ten feet, and are divided into numerous rhomboidal masses by fissures, into which lime has been deposited; and in the bed of the river, numerous fragments of calcedonies, zeolites, and other minerals found in volcanic rocks, are partially cemented by lime. The banks are mostly composed of black cotton soil, and the lower part is covered with small irregular loose slabs, resembling the dried cow-dung used for fire; which are found in sitû projecting from the bank, and connected above with portions formed round the roots of plants, and below with other layers spread out between different strata of the alluvial earth.

From the top of the hill of Nugger above spoken of, numerous insulated hills, and short ranges of a similar form, are seen to rise from the granitic tract to the east and west, but they do not observe any particular line of bearing, although the whole group seems to pass in a direction from east to west, like the other basalt ranges of the table land. From this hill to four or five miles north of Nírmul (a large town nine miles north of the Godavery) as in almost all other parts of the peninsula, is intersected by numerous greenstone dykes, which generally run from N. by W. to S. by E. These dykes are of great importance to the agriculture of the country, as the granitic soil is extremely thin and poor, except in the valleys, where the clay formed by the decomposed felspar accumulates, and bears fine crops of rice, for which water is collected in tanks, often in a great measure formed of natural mounds of rounded or angular fragments of greenstone, which is little subject to decomposition. At Jakrampilly, there is a remarkable dyke of this kind, which can be traced for several miles by a series of tanks on one side of it: it is also remarkable in exhibiting, where it rises into a small hill near the village, the gradual transition of the granite into the greenstone, and in the latter, having a tendency to split into regular forms. When once a fissure, however small, is formed, the rain washes a gradually increasing portion of lime and other soluble parts of its surface into the interstices, until the masses are separated, in which the alterations of temperature probably assist. It is difficult to account for the manner in which the greenstone passes into granite in this instance; but it is evident, that it has been raised by the granite above the continuation of the dyke at either end of the hill. I have been more minute in the description of the hill of Nugger, principally with the view of affording some information relative to the distinction of the basalt ridges, which have burst through the granite of the Deccan, from the greenstone dykes, which are of such frequent occurrence. The presence of olivine; the soft wacke in which the globular basalt is embedded; the less crystalline structure; the passage into amygdaloid containing calcedonies, zeolites, &c. and the granite in the neighbourhood of all the *smaller* masses of basalt, differing little from that at a distance, may perhaps be sufficient to distinguish these important rocks from each other. The separation of the different ingredients of the granite into large crystals, and the insulated masses of greenstone found in it near the dykes, prove, that the rock had been softened by heat; but judging from the appearance and great length of many of these dykes, I do not think that they were of contemporaneous formation with the rock through which they pass. Near one of these, at Secunderabad, a smooth, wall-like dyke of white granite passes through the sienite.

At Balcondah, 21 miles north of Jakrampilly, these dykes occur on the large scale, and the granite is much separated into its constituent parts, the felspar being of a fine red colour. Nine miles further north, in the bed of the Godavery, the felspar is of a still more beautiful red colour; but good specimens could not be removed. Veins of quartz also occur at Balcondah, with turbid milky spots, as if altered by heat, and large imbedded crystals.

* *Síchel Hills; locally known as the Nírmul range.*—Nìrmul is surrounded by granite hills, containing much hornblendeand a little schorl; and the summits of some of them appear to resemble the greenstone of Jakrampillay, but they were not examined. After passing some small ranges of hills, the ascent of the Nírmul chain commences five or six miles north of the town, and the road continues amongst lofty hills covered with forest, by a succession of ascents and descents, for 40 miles, when it descends by the Muklegandy ghat to the town of Eidlábád, nearly on the level of the flat country of Berár.

The southern ascent of Nírmul ghat, is the most deep and difficult, the hills not rising in a series of terraces as they do to the north; yet it is not easy to ascertain the precise direction of the part of the hill range over which this pass leads, on account of the projecting spurs and low hills at their base, the thick forest with which it is covered, and from its having something of a curved form. The general direction is from W. N. W. to E. S. E., which corresponds with that of the Sichel range, to which these hills belong, and which extends from the great lake water of Lonar to the neighbourhood of Mungapett, where the silicious fossil wood was found. On approaching the hills, the granite is observed to become soft, and to decompose rapidly. In the bed of a stream it has a remarkable concentric appearance, which was also observed in the centre of the hills south of Thitnoor, where it is covered by trap, on which fossils were found. No schistose rock was found here, but 20 miles to the east of Nírmul, and a few miles south of the mountains, hornblende slate occurs on the granite, and along with it the magnetic iron ore described by Voysey in the Journal of the Asiatic Society, vol. II. It is not a sand, as might be inferred from his description; but the grains of iron are either mixed with the hornblende or occur in a sandstone-looking gneiss, from which the hornblende had disappeared. Specimens of the rock, which I saw dug up, and of the sand formed by pounding it on protruding masses of granite, are forwarded. The softer pieces were at once reduced to powder, while the harder were first roasted; and the one was then easily separated by

* Also called "Shesha."

washing in small shelving hollows dug in the clay. It is then melted, and its quality said to be improved by using teak branches: the iron is soft, but part is used in the mixture from which wootz steel is formed. The strata of the schists have been broken and elevated, but the dip and direction are in no two places the same. Here also, the granite was seen, in the bed of a torrent, in thin concentric scales, not unlike the extremities of petrified trees, caused by the unequal waste of the component parts, the quartz projecting unaltered.

On approaching the hills, the soil gradually became black, with scattered fragments of calcedony; and at the first part of the ascent, which is for some distance very gradual, a singular fragment of semi-vitrified matter was met with, containing small white crystals of felspar. It could not be distinguished from a piece of granite fused in a steel furnace, with which it was compared by Dr. Voysey. At the same place there were fragments so much like iron slag, that till I found them in a large mass resembling a dyke, I supposed that they were the product of a furnace. The granite continues the surface rock a little further, passing into a black hard basalt, intermixed with many white spots, apparently of felspar; but I saw none of them rounded or distinctly crystallized, forming amygdaloid or greenstone porphyry, such as occur at the lower part of the pass leading to Eidlabad. On ascending the last part of the base of the hills, the surface was strewed with calcedonies, quartz, and other minerals of the same family, and amongst them, a few fragments of a softish white clayey and silicious stone, containing small shells of fresh water families. The trap then became softer, more vesicular with calcedonies, zeolites, &c. imbedded, and the surface covered with tabular crystals of the same kind as those remarkable in the Poonah trap rocks; and latterly concentric, the external layers decomposing, and the nucleus lying in a soft greenish wacke. I spent several hours in ascending the highest points of the range, but was unable to discover any beds of fossil shells; large blocks of quartz were, however, observed, with a singularly angular surface, and sometimes with fine capillary crystals, much of which was found with the fossil fragments; and afterwards, in the same position and partaking of the characters of the fossiliferous masses found in sitû. These blocks were seen extending along the steep face of the hill at the same level as if they had been forced out of the mountain, or rather, as if the basalt, when erupted, had covered, and partially melted the bed on which it lay, and thus caused the singular appearance of those blocks. The highest summit east of the pass is caped by some horizontal strata, having some resemblance to sandstone that had been altered and blackened by heat; what its real nature was, I could not determine.

The hills, for 44 miles by the road, are arranged in terraces with steep sides and flat summits, rising now and then into conical elevations, with rounded or flat tops, and inclosing narrow valleys, abounding in streams, or small table lands with water every where near the surface. On some of the ridges, the globular basalt becomes columnar, near which no trace of fossils, and hardly any calcedonies have been found. A thick wood and grass jungle, composed of very different plants from those most common on the granite hills, cover the whole tract, and render it unhealthy for the greater part of the year. In a deep valley, about the middle of the hills, where the Kurm or Kurrum river passes through them, the basalt is seen to rest on friable granite, (as near Nírmul to the south and Eidlábad to the north, and at one or two other places,) and a level plain of considerable extent and deep black colour extends to Etchoda to the neighbourhood of the shelly rock. The fossils were first found at Munoor, and between the village and Thitnoor, which is near the top of the Muklegandy ghaut. The most remarkable were found in the beautiful grey chert, which either projects from the basalt in which it is imbedded, or rests in large blocks on the surface. The side on which they rest is remarkably smooth and even, while the others are rough and covered with bivalve shells of great size, and some of them having the epidermis still entire, resembling a recent bed of shells on the sea shore. A few univalves also occur converted into flint, and it is remarkable, that one small bivalve, thus altered, retains its colours. The masses are evidently in sitû, and have probably been consolidated by the basalt, with which they are surrounded, or on which they rest. Some specimens exhibit a mixture of sand and mud, merely slightly agglutinated and intermixed with fragments of shells; the greater part is converted into chert spotted with fragments, or containing the shells in a perfect state; in other places, the materials have arranged themselves into an enamel-like substance around irregular cavities containing fine crystals of purplish quartz, and in one specimen a formation of calcspar has taken place. Throughout the rock perfect bivalve shells, both closed or open, occur in the situation in which they had lived and been entombed. The most perfect are closed, and some of them are easily separated from the rock to which they are slightly united at a few points only; they are filled with the stone, mixed with fragments of minute shells, and some are entirely converted into chert, which retains the form even of the ligaments so completely as almost to lead one to expect to be able to open them.

Between Munoor and Thitnoor, masses of red chert project from amongst the basalt, and contain various shells, mostly univalves of small size, and some of them evidently belonging to fresh water genera. Near to these many fragments of different kinds were found

lying loose on the surface, and abounding in shells of various families. Some in a green crystalline mass, resembling an ore of copper, were in many instances converted into quartz crystals, retaining the perfect form of the shells ; one of these of exquisite beauty, which has been unfortunately broken, was found in the interior of a larger one : others were imbedded in a tough white clay rock, so soft as to soil the fingers. The greatest part consisted of a siliceous rock, partly converted into a black bituminous flint, or a coarse quartz, partially altered into calcedony, into which the majority of the shells were converted. Some, on the contrary, retained the structure of the shell unaltered, and effervesced with acids.

Amongst these, the fragments containing the fossil seeds of chara, associated with fresh-water shells, were found. The gyrogonites were not observed at the time the specimen was found, but the rock to which it belonged could not be far distant, as the shells are of the same species as in other specimens, having a similar mineralogical structure. In other fragments, remains of grasses appearing half consumed were seen ; and in the large protruding mass of red chert, containing shells converted into calcedony, I discovered what I take to be the tooth of an herbivorous quadruped. A few of the shells I believe to be marine, and at the distance of half a mile, the principal masses of grey chert, containing the large marine shells were found.

On descending towards Thitnoor, granite is seen at one place, and above, much quartz, having a slag-like surface of the kind seen above Nírmul, occurs. A few specimens of black chert, with shells, were picked up in the bed of a nulla at Thitnoor, where it was also found in sitû. A loose piece of reddish and green flint, with shells, was also met with in a ravine three miles further north. Much lime and kankar was here mixed with the black soil, or was deposited in the water courses ; the greater part probably derived from the decomposed basalt, or from such layers of a soft white limestone, as were found between the laminæ of basalt, in digging pits to obtain water for the troops, when encamped at Etchoda. A compact stratified limestone, however, occurs in the vicinity.

The pass from Thitnoor, called the Muklegandy ghat, is formed of several terraces, of which three only are remarkable, and a steep descent between each. The surface rock of the second terrace is a rough, white limetone, which appears to be consolidated in nodules, until it was broken, and found to consist of a great variety of shells, many of great size, but difficult to remove entire, forming a rock of a crystalline texture. The strata are horizontal, and in one place, where it is cut through by a torrent, the rock is 12 feet thick, and *is seen to rest directly on granite of* a reddish colour. The shells are of very various forms: several belong to the genus Ostrea of Linnæus ; one very

perfect Cardia was entire, both valves being connected, and one fragment, of a very large shell, has the water-worn appearance often seen on the sea-shore. The edges of the large shells are harder than the rest of the rock, and stand out from it, which has led the natives to compare its surface to the impression left by the feet of sheep, and to name it "Bakrí ke páun ká patthar." Over the surface, many fragments of basalt, calcedonies, &c. are scattered, derived from a lofty spur of the higher point of the mountain, which rises precipitously from the terrace within a few hundred feet of the fossil strata. A very remarkable mass of soft peperino, resembling ashes, seemed to proceed from the limestone, where it begins to be lost amongst the debris of the mountain; and amongst the loose fragments, were some very tough clayey stones, having the forms of small univalve shells adhering and embedded.

The facts above described, and the nature of the different fossil beds, more especially this great accumulation of marine shells *resting immediately on granite*, and the fossil seeds of charæ, now perhaps first found in India, leave no doubt on my mind, that this wild mountain country, now covered with a dense forest, had once been the bed of an inland sea or great estuary, on whose shore the charæ and associated fresh-water shells had flourished.

On descending the pass towards Eidlábád, the rock changes to amygdaloidal trap, with occasional masses of greenstone porphyry, having large crystals of felspar imbedded. The opake milk-white quartz, and the beautiful white porous crystalline mineral, which accompany the fossils, were found here, and were not met with elsewhere. At the foot of the pass, granite re-appears, and protrudes in great masses from the soil, for about four miles on either side of the town of Eidlábád*.

Basaltic Tract between Eidlábád and Nágpur.—The greater variety of rocks that occur between Eidlábád and Nágpur, and the interesting appearances they exhibit, will render it necessary to enter somewhat more into detail in describing the localities whence the specimens were collected; so as to afford the means of determining their relations to each other, and to the fossil deposits already described; as well as to the great western trap formation, and the stratified rocks to the north and south.

The bed of the small river of Eidlábad (see map) is covered by numerous fragments of the argillaceous blue limestone, so well known as underlying the diamond breccia in the Cuddapah district south of

* The localities of some other minerals found in the Nirmul hills are marked on the specimens. The blood-red chert found in the valley of Ankni is remarkable.

the *Kistnah*. Three miles higher up, the stream runs over the slightly inclined strata of a fine white sandstone, having some quartz fragments imbedded, rising towards some lofty ranges of trap formation to the east, (the Manik-gurh hills*,) and are in some places converted into a quartz-like mass, as is seen in some of the Cuddapah sandstones. It probably rests on the blue limestone, which is seen to pass into a soft bluish or reddish clayslate in the bank of a stream a few miles north.

About 10 miles N. of Eidlábád, the limestone is found on the surface, forming smooth slabs, having much calcareous spar and rock crystal between the strata, and in their veins through the rock, and in the course of the natural fissures, numerous small round perforations are arranged in lines, and occasionally filled with soft calcareous matter. On a rising ground south of Zeynád, the marble had occasionally a dip of 40 degrees; but for the most part it was nearly horizontal, and the direction of the dip was quite irregular. In the nala of Zeynád, which runs over limestone, there is much tuff, having small pieces of the limestone imbedded, and evidently formed from the water of the stream; a similar formation is, however, found in a few places on the high level ground to the S. W. To the east of the village a gently rising ground extends nearly N. E., and S. W., for about three miles, and terminates in a small hill, which rises rather abruptly. The slope is formed of nearly horizontal slabs of marble, the edges of the strata being exposed by the gradual rise of the surface. In following the ridge to within half a mile of the little hill to which it rises, a singular appearance presented itself: a dyke of perfectly vertical stratification, about three feet in thickness, projects two feet from the general surface; its exterior is singularly irregular and altered, the constituents of the rock being formed into crystalline or flint-like minerals of lime, argil, or silex, while the internal structure retains the characters of the blue limestone. On following this natural wall for about half a mile, it is concealed by globular basalt, which has burst through the strata, and in forming the termination of the little ridge, has covered the surrounding limestone, of which a portion has been so singularly displaced. The basalt is vesicular, and resembles much of that found in the Nírmul hills. No fossils were found here; but in the ascent from the second terrace of the Muklegandy ghát, where the great bed of marine shells was incumbent on granite, the same limestone was seen in sitû, greatly broken up by the eruption of the precipitous trap ridge, on which it was seen. The thickness of the grass and wood jungle prevented its being traced with sufficient accuracy. Fragments of the same rock were also seen at Thitnoor; and a very similar rock was

* The Manik-gurh hills run from N. by E. to S. by W. almost at right angles to the Nírmul range.

observed in horizontal strata at Muneer, not far from some great blocks, containing marine fossils, in one specimen of which small univalve shells were found. But as this locality was only examined by torch light, I could form no judgment as to the formation being the same; although the total absence of fossils in the blue limestone over extensive tracts in which I have searched for them, incline me to think that they are different.

The relative age of the blue limestone and great trap formation, to which these hills belong, being ascertained by these and other facts; it may be hoped, that a careful comparison of the fossils will assist in determining the period to which other rocks occurring to the north and south belong. I have not been able to detect amongst them any of the Himálaya fossils; but some fragments found in indurated clay at Jirpoh, near the hot springs in the valley of the Nerbada, and in a specimen from the Gawilgurh fossil rock, described by Dr. Voysey in the 18th vol. of the As. Res. appear to belong to some of the same shells.

The march to the Payngunga river is over a flat country of black soil, modified in some places by a mixture of earth derived from slate clay, which appears occasionally at the surface, and of the same kind as that found below the limestone of Cuddapah, or which takes its place under the diamond breccia of Banganapilly. Jaspers, striped red and white, are found in the black soil. Scattered over this extensive plain are a number of small conical hillocks of white kankar, apparently formed by springs issuing from the centre, and now dried up: in some of them the apex is a little depressed. Several long straight ranges are seen at a distance, generally flat on the summits, but occasionally rising into cones, with a lengthened base, corresponding to the direction of the hills. About half up the greatest height a remarkable line extends all along, on which the summits appear to rise as on a terrace, or like the parallel roads of Glen Roy.

The pebbles of the Payngunga are principally calcedonies of a reddish colour and the blue limestone. Calcareous sandy tuff is found on the banks of this fine river, as high as 25 feet above the water at the fort; and is always horizontal, with black soil between the layers, which are from an inch to three feet thick. The surface is irregular, but seldom or ever shoots into branches like the tufa of the Godavery, and holes occasionally occur in the layers, from a deficiency of lime; in other places, it projects three or four feet, in consequence of the soft soil being washed away. In one of the specimens, numerous recent shells are imbedded, which correspond in situation to a layer of these left in the sand by the last fall of the river; and it is evident, that the tufa is formed from the infiltration of the lime with which the black soil and the water of the river abound, into layers of sand. In all these rivers, and in the stream of

Bibbery and others running into the Godavery above Badrachellam, beds of limestone conglomerate, cementing agates and calcedonies, are continually forming.

The country between the Payngunga and Kair *has at all seasons* many springs and streams of pure water; which give a lively and beautiful green to the vegetation, when the surrounding country is burned up by the scorching heats of May*. The first of these streams is at Lingtee, the water of which is loaded with lime, which it deposits on its bed in a thick incrustation of tuff. Loose pieces of branches, petrified by lime, were found on the banks, and a wall of kankar six feet high, seemed to have been formed from a spring which had gushed from a fissure in the blue limestone, which is here the surface rock, and rests on a reddish, very friable slate clay, as is seen in a section a mile further down the stream. A black flint, resembling anthracite, was found higher up. This stream, which, in the driest weather, has sufficient water to drive a mill, is said to have its source about six miles distant in a low range of hills, over which the road passes more to the east, a little to the north of Urjuna, and three and a half miles from Lingtee. At this village, a small stream takes its rise in a hot spring, whose temperature, as it gushes from beneath the wall of a half ruined reservoir was, in December, 1833, almost 87°. Copious springs also rise in the bed of the little stream; and globules of gas are extricated from round holes in the mud; but on endeavouring to collect a quantity, it was found that there were considerable and irregular intervals between each jet of air, nor did it always issue from the same place. The springs rise through the blue limestone so often mentioned, which, in a section in the north bank, is seen to have been raised by some violent forces, in a very singular manner, so as to form a series of irregular peaked gothic arches, overlaid by partially broken but horizontal strata. The spaces within the arches are filled with fragments of the same rock, all evidently forced from below. The bed of the stream has a covering of sand, which, some way below, is agglutinated by lime into a tolerably hard rock. The sand is derived from a quartoze sandstone, which crops out in two or three places from the ascent south of the spring. The strata are not horizontal, but neither the dip nor line of bearing could be observed.

North of Urjuna the rock is concealed by the soil as far as the Pindee ghat, nearly a mile distant, which passes over the steep low range, in which the Lingtee nulla rises. Its top is rounded, but on either hand, several conical summits are seen outlying from the range, which extends for some way from N. W. to S. E. On leaving the

* The same was observed of the beautiful stream at Bibbery, in the month of May, 1828, and inclines me to think, that it derives its source in springs like those of Kair, to be presently described. It rises in the Nirmal range.

plain of Urjuna, the blue limestone disappears, and the hill is found to be composed of the usual black concentric basalt, the nuclei of which are exceedingly hard, and contain much olivine: they are imbedded in a soft grey or greenish wacken. I was surprised to find the road and a ravine descending from the hill strewed with the limestone I had left below, and did not quite credit the guide, who pointed to the top of the hill as the locality from which they came. I, however, soon came to it in sitû, in its characteristic large smooth slabs, which render it so difficult to pass on horseback. They were observed to be slightly convex upwards, to be very much fissured in various directions, and if taken in the mass, to have a slight anticlinal dip, although on the top the slabs were horizontal and several places remarkably altered, as if they had been half fused; the argillaceous and silicious matters having arranged themselves into beautiful streaks of a pale blue enamel, passing into calcedony, or crystallized in minute prisms. Some parts of these strata had acquired a deep black colour, and a flinty hardness. On descending the hill on the opposite side, the same appearances presented themselves, and left no doubt of the limestone having been raised from its connections by the intrusion of the basalt, which had slightly bent the strata, and in doing so, had caused the numerons fissures, and the alteration of structure. North of the Pindee ghat, there are a number of very low rising grounds, flat on the top, and composed of black globular trap rocks: and on the valleys, many large coarse masses of calcedony are scattered; of which, on a slight examination, I saw none in the hills. Near this, limestone was found in the bed of a nulla. A little further on, there are two very black conical hills of trap, and at their feet, great fragments of rock crystal, but of no beauty, and having cavities lined with calcedony. From hence to Kair, the country is more level, rising however a little, to the right of the road; and four miles from the Pindee ghat, and the same distance from Kair, I found sandstone. It was only seen in a small nulla where its strata appeared to be horizontal, and was white, red, or of a fine yellow, easily decomposed, and having small metallic veins passing through its substance, and in one or two places, passed into a breccia cemented by lime. No other rock is found at a higher level. I had been induced to examine this extensive slope, as the occurrence of the blue limestone suggested the probability of a sandstone or breccia being found above it, as in Cuddapah, before I discovered the sandstone at Urjuna, and near Eidlábád; I was therefore much gratified by finding it, although different in mineralogical characters. The country did not afford any section, but the sandstone probably rests on the blue limestone, which is met with at a lower level, two miles to the north-east. A mile and a half south of Kair*, the

* This small town must not be confounded with a large place of the same name on the Godavery.

road crosses a small river, where there are some masses of travertine several yards square, which have been carried down by the stream: they are entirely composed of petrified branches and leaves, with a cement in some parts of considerable thickness, and more or less crystalline, or resembling kankar.

The stream rises near the town in copious hot springs, whose water is considered to be exceedingly pure and delicious; but when taken from one of the springs, where it can be directly received, was found to be acid to the taste, and, on boiling, deposited lime, which the carbonic acid had held in solution. Bubbles of gas are also extricated with the water, from one of the springs. The lime separates in its course, giving a whitish appearance to the water of the pools, while it sparkles near the springs and in the rapids, as was the case also at Lingti. The temperature of the spring, in 1831 and 1833, was 87°, and is the same in May, June, and December; but the difference to the feelings, according to the temperature of the air, is so great, as to have led to the belief that it is cold in the day and hot at night; the thermometer, however, showed that it was the same at 3 P. M. and 5 A. M. of the 5th June, when that of the air was 100° and 81°. The principal spring rises at the root of a great Banian tree below the pagoda, and is stated by the devotees to flow in the same profusion the whole year, which they account for by saying that it flows from the Ganges at Benares. This and other springs form a stream, that increases as its course is followed downwards, notwithstanding that much is directed to gardens, and a fine sheet of paddy in the bed of the river thus formed. About half a mile below the spring, the first formation of rock is found crossing the stream like a dyke, but of a considerable breadth; others more remarkable are found lower down, and after a winding course of 2½ miles, it seems to cease. The congeries of branches, roots, and even trees, sometimes hollow, and always in concentric rings of deposit, forms a beautiful sight when in masses of several tons weight. The strata were seen in one place to be 12 feet thick, and to rest on the common black alluvial soil; near this, it had filled the original bed of the stream, and forced it to find another channel: and in two places, a fall of three or four feet, forming a pretty cascade, seemed to be occasioned by the growth of the rock, and the wearing away of the channel below. The deposit often conceals the remains of plants, with a smooth coating of considerable thickness and firmness, frequently rounded in irregular sections of large circles; in others, in nodulous forms of great beauty, covering over the extremities of the smaller or larger branches, and occasionally preserving the wood in an hermetically-sealed cavity. The roots of the Banian now and then pass into the empty tubes, as if they were the mould on which they are formed; others probably

form on the weeds, which flourish in the wildest luxuriance along the banks: one of these I found to be 24 feet in height. Recent shells, such as now inhabit the stream, were found in many places enveloped in the stone. One fine specimen of *lymnæa* was attached to the side of the rock, as if it had been arrested there by the deposit of stone around it, and which has taken its shape; its fine surface, where it adhered, being that of the fresh shell; while the coating exhibited the colour and fracture of the tufa of the hillocks south of the Payngunga, and others exactly similar, near the town of Kair. Roots and branches were seen to lie in the deep water without a coating of stone; but the series of observations so accurately described by Mr. Lyell was completed, by finding where the stream fell over some rocks, a plant still living, whose roots were thickly interwoven, and the leaves on a level, and just above the water, cemented into a mass of firm white tufa.

The spray seemed, therefore, to produce the deposit more quickly; but specimens of moss growing below the water were also converted into sharp brittle spiculæ.

Below, some blocks were softened, and as if in part re-dissolved. Amongst the petrified plants, one tree 1½ foot in diameter was seen; and also a few leaves; but these were rare, I suppose from their rapid decay and smooth surface; one of them seemed to belong to a species of lotus seen in a pool above; and another seemed to be the leaf of aloe. In some places the tufa was sandy, and in one or two slightly tinged with iron; some of it had a fine crystalline appearance, and considerable hardness; while other specimens could not be distinguished from kankar. A tendency to the formation of a bluish white scum was observed on the surface of the still water, both here and at Lingtee: a slight smell resembling sulphur was also occasionally perceived; and at the latter, our people procured water of a very offensive taste, although perfectly clear, from a well which I did not see.

The water abounds with animal life, and the banks are covered with a profuse vegetation, amongst which many fine insects were seen; and in the hot season, all forms of life seem to gather round this oasis in the black burned-up country around. The banks and water affording so much food, vast numbers of birds of different species, game, doves, kings-fishers, herons, &c. are collected together, whose habits a naturalist might spend months in observing, without exhausting the field of inquiry.

All the springs seemed to be equally loaded with calcareous matter, and similar formations by springs now closed up are seen on a rising ground down the river. Here too, the globular trap again appeared on the surface in several places, of small extent; one was a little to the west of the greatest formation of travertine, and another below the ford

where the hard nuclei were surrounded by layers of a grey friable wacke like that of the Nírmul hills, and are curiously divided into compartments by tufaceous partitions. Near to this, the blue limestone is again found in extensive slabs, slightly raised from its horizontal position; but as usual in no regular direction, the strata occasionally meeting each other at an obtuse angle. The same remark applies to the rock as seen to the north of the springs on the road to Won, and to almost every other place where I have met with it. Near the last mentioned bed of basalt, some irregularly inclined strata of blue rock, having a granular sandstone-like aspect, were seen, and at no great distance, large loose masses of vesicular scoriæ were found.

But the most interesting appearances are seen, in a small irregular rising ground, above the pagoda at the principal spring. The basis of the rock is a tough white limestone, projecting from the gentle rising ground in very irregular masses, passing into curious and beautiful jasperous minerals, often coated with minute rock and other crystals; and the whole is perforated by large cavities, and even holes, evidently formed when the rock had been erupted in a semi fluid state. Much tufa is associated with these altered rocks, filling up many of the cavities, and having various minerals imbedded. I believe that few places exhibit so many of the most interesting effects of volcanic action, as the small district around Kair; more especially in altering a stratified rock of apparently uniform stucture, so as to form a great variety of minerals*. A good deal of sandstone has been used in the old buildings, which the inhabitants stated to be brought from Sacra, five miles to the west.

To the north of Kair, the limestone resumes its blue colour; the soil is black, and a little further on, mixed with calcedonies, &c. In the nulla at Won, quartz sand, sandstone, and a mineral resembling pudding-stone were picked up; and at the foot of the hill, the remarkable vegetable fossils figured in the fifth number of the Madras Journal, and now deposited in the museum of the Bengal Society. The small hill of Won is composed of sandstone of different colours, red, white, and yellow, and waved lines of a black colour from disseminated iron, pass through it in various directions—the composition of which is the same as that in which the fossil is contained, and the sandstone from between Urjuna and Kair. The strata have been elevated by the convulsions to which the rest of the district has been subjected, and have a dip from the apex of the hill, varying from 35 to 55 degrees: their direction on the southern face of the hill, is nearly from E. to W., but to the west they turn off towards the rising ground on which the town is

* In some specimens, the surface has the appearance of a semifused brick, which had assumed something of a regular arrangement, whilst the centre is composed of the blue limestone little altered.

situated, the line of bearing of the strata being from S. E. to N. W. The swell of the hill extends some way to the east, but the country is on the whole level. This sandstone is also found to the eastward in the basin of the Wurdah and Godavery, beyond Chanda.

Sand derived from these rocks forms the soil for two miles north of Won: between that and the Wurdah, it consists of the basaltic black soil, and the gravel of that river is composed of calcedonies, agates, &c. of which a calcareous conglomerate, in horizontal strata, two or three feet thick, has been formed.

At Waronah, white sandstone and a yellow slate, apparently belonging to the clay slate formation to which Voysey refers the blue limestone, is used in building; and one obtained from a hill five miles distant, which I had not time to visit. Most of the pagodas between Hingan ghat and Chanda are built of the same materials. Between Waronah and Chiknee the country is level, well cultivated, and the water within a few feet of the surface; much fever prevails after the rains, although there is no wood or marsh. Basalt protrudes from the level soil, and near it, the bed of a small nulla displays strangely altered strata of the red slate clay, seen at Lingtee, which is broken up, and intermixed with crystalline nodules and layers of calcareous spar, having a red clay in the interstices. At Dyeghám, two miles further north, and about the same distance south from Chiknee, it is seen dipping to the west of south at a considerable angle, is much fissured, and is reticulated with beautiful veins of calcareous spar, filling up the vertical interstices, which vary from a line to half an inch in breadth; they intersect each other in all directions without disturbance, and were evidently formed at one time.

To the east of this, and of the village of Chiknee, there is a very gentle rise of the country, and concentric basalt and great round trap boulders are seen wherever the soil has been removed. On this are found numerous great blocks of indurated clay, of remarkable hardness, and exhibiting all the varieties of that mineral, of flinty slate, of compact schist, and of semi-opal*. Many of these masses are also found imbedded in the basalt; and on a very careful examination, the inference could not be avoided, that they owed their different appearances to the greater or less heat to which they had been exposed. Most of them are full of large and small univalve shells, many of which are of fresh-water genera. Many of the shells are changed into opal, others are covered, or their shape taken and preserved by quartz crystals; while the shells of a few can be separated unaltered and effervesce with acids. The spines of the small shells are often

* Loose specimens of this rock were seen by Mr. W. Geddes, Surgeon of the Madras European Regiment, in 1829, who directed my attention to ascertain their position.

insulated in cavities in the rock, and their crystalline surface is often very beautiful, when examined with the microscope. Some vertebræ and the head of a fish were met with; but from the great toughness of the rock, part only could be broken off, and a portion of the same block was converted into a red flint, with shells changed into opal. A large loose block of a slaty structure was found near this, containing fragments of very large bivalve shells of great thickness, along with wood converted into a black flint, intersected by fine veins of a light purple opal; and other bivalves which had been crushed together, were found in a flinty state on the upper part of the rising ground. I do not think that I go beyond the limits of correct inference, in supposing these shells to have lived in a mud formed from the decomposition of the clay-slate found in the neighbourhood, and through which the trap is seen to have burst*.

The country to Naugri continues to be composed of basalt, which is in some places tabular, with green earth between the laminæ; and the soil is covered with calcedonies, ribbon and pudding stone, jaspers, resembling those found in the Nirmul hills, to which the whole character of the formation remarkably assimilates, and leaves no doubt of their belonging to one great period of protrusive violence.

At Naugri, fossils like those of Chiknee are formed; and with the conical masses of calcedony, having a smooth flat base of cachelong, the centre being filled with quartz crystals and calc spar; which were afterwards seen in sitû at Hingan ghat, inserted between the globular basalt with the apex downwards, the peculiar appearance of the base being perhaps caused by slow cooling.

At Hingan ghat, a number of blocks, loose, of a black and red chert, containing silicified branches of dicotolydonous trees, and a very perfect portion of a palm (date ?) tree were discovered: and the same kind of rock, but without fossils, protruded from the basalt a little below Colonel Lambton's tomb. The basalt was globular, but seems to have had a tendency to form five or six-sided prisms. The rest of the route to Nágpur is over a level country, from which a few insulated trap hills rise abruptly, on whose summits basaltic columns are occasionally met with. On the south side of the small range of hills near the city, these columns are very regular, and inclined to the south, at an angle of 45°, in consequence of which many of them have fallen. The flat top of the hill forms a pavement of the ends of similar columns perpendicular to the horizon. The round flat topped hill of Sitabuldee, which is accurately described by Voysey in the 18th volume of the As. Rs. is separated a few hundred yards from the extremity of

* Shells were first found here by Mr. W. Geddes, late of the Madras Medical Establishment.

this range, and rests on a decomposing granitic rock; its great and irregular masses show a similar tendency to crystalline arrangement, and thin sheets of calcedony are found in the joints.

To connect these observations with those published in the As. Researches and Journal, on the countries south of the Nerbada, it is necessary to mention, that at the cantonment of Kampty, eight miles north of Nágpoor, the sandstone is met with in the north bank of the Kanan river; and a mile higher up, the granite has been forced through the strata, bending or converting them into quartz rock. The crystals of felspar and plates of mica are remarkably large, and mica slate is seen in a quarry a few hundred yards distant. Beyond this are some small hills of upraised gneiss; near to which a conical hill of curiously altered rock, resembling that above the hot springs of Kair, has burst through a limestone, which it appears to have converted into a fine crystalline bed, like that found in the primitive districts of Scotland. From the summit of this volcanic rock the basaltic hill of Sitabuldee and others are seen to the south and west; and at the same distance to the north, the rounded mica slate and granitic hills of Ramtesk, which extend into the Bengal territory south of Ságur.

An examination of the map will impress more strongly, than any thing I can urge, the importance of examining the whole Sichel or Shesha range, from the great lake water of Lonar, (to which the attention of your readers was called in the number of Journal for June, 1834,) to the fossil beds of the Nirmul hills; and from thence to Bibbery, the fossiliferous localities above Mungapett, and the hot springs of Byorah and Badrahcellam. Other hot springs are also said to be found in the Nírmul range, regarding which I could get no correct information.

There are three other points to which it may be well to call the attention of such of your readers as may have an opportunity of visiting these localities.

1*st.* Whether the Sichel hills really terminate about Mungapett, or are continued in broken ranges towards Rajamundry? I have long considered it probable that the dykes so common in the Circars are connected with the great basaltic ranges which cross the Deccan in nearly the same direction; and Dr. Benza has recently discovered a bed of marine fossils on the top of a basaltic hill five miles south of Rajamundry, and a little above the alluvial plains of the mouths of the Godavery.

2*d.* Whether the basaltic hills near the Manjerah river, on which Dr. Voysey discovered fossils, are connected with those of Bekanurpettah and Nugger above described; and whether they belong to the same geological period as the Nírmul hills?

3*d.* I entertain little doubt that the basaltic formation of the valley of Berar and the basin of the Panah river, which falls into the Tapti, belongs to the period of eruption which elevated the Nírmul fossils from the bed of the sea; before, however, coming to this conclusion, with reference to the northern part of the valley, the connection between the localities of the Nírmul and Chiknee fossils with those of the Gawilgurh hills (A. R. vol. 17th) must be ascertained.

4*th.* The exact relations of the crater of Lonar to the great volcanic district to the N. W. where fossils have not yet been met with.

But as the difficulties opposed to the investigation of the greater part of such wild and unhealthy tracts will probably prevent these desiderata being soon supplied; I hope that a sufficient number of organic remains have been obtained from the central point of the district, to enable an experienced geologist to arrive at a tolerably correct estimate of the relative age of part of the great trap formation of the N. W. of India, which the President of the Geological Society in the anniversary address to that body in 1833, stated to be quite unknown: " no vestiges of secondary or tertiary formations having been detected within the region described."

*** We could not do otherwise than transfer the foregoing to our pages, both on account of the interest imparted to it from the well known character of the author within this Presidency, and because it refers to a district in the Madras provinces concerning which Madras readers alone are likely to have the means of affording information, on the points stated by Mr. Malcolmson to be still in need of further enquiry and elucidation. We are also very desirous of imparting a taste for geological studies throughout the Madras Presidency, where so little has been done until lately in that department of Science. The progress made by Bengal geologists has been so exceedingly great, that it behoves those interested in science on this side of India, to bestir themselves, if there is any ambition amongst us not to be left behind in the intellectual race.

Mr. Malcolmson has erroneously ascribed to Colonel Cullen the application of the term " argillaceous" to the Cuddapah limestone. In that gentleman's paper on the *Geological features of a route from Madras to Bellary,* contained in the *Madras Transactions,* that word is not employed to designate the rock.

It will also be observed that Dr. Benza, in the first article of this number, attributes the original discovery of the fossils near Rajahmundry, to Colonel Cullen who deposited specimens in the Cabinet of the Society in 1822.—*Editor Madras Journal.*

Sivatherium Giganteum, a new Fossil Ruminant Genus, from the Valley of the Markanda, in the Sivâlik branch of the Sub-Himalayan Mountains. By Hugh Falconer, *M. D., Superintendent Botanical Garden, Sehâranpur, and Captain* P. T. Cautley, *Superintendent Doâb Canal.*

*** "Within the last few years the progress of fossil geology, that talisman by whose aid the secret history of our earth is laid open, has been most rapid."* If this is true as relates to Europe, it is equally applicable to the history of geological discovery in India. No longer since than 1829, Mr. Calder observed—"With regard to organic remains (the most interesting of all the branches of geological science) it is to be feared that India is not likely to prove a productive field."† Even so late as 1832, we find Mr. Conybeare in his Report on Geology to the British Association for the advancement of science, expressing his surprise at "the general absence of organic remains in the secondary rocks of India."‡ Since the last mentioned date, discovery, has followed discovery, until the Indian fossil fauna begins to vie with that of Europe and N. America in extent and interest; and now we have to record that the remains of a species of animal have been found whose analogue is unknown in the geology of the west. It is to the impetus given to discovery by the Asiatic Society of Bengal, through the pages of their Journal, edited by their talented and energetic Secretary Mr. James Prinsep, to whom science in India owes more than to any other individual at the present time, that these rapid and extraordinary progress is attributable. To the pages of the Bengal Journal, *passim*, we must refer for descriptions and delineations of the fossils alluded to; and proud and delighted shall we be if our pages should be the medium for communicating to the world similar discoveries in the Peninsula of India. Colonel Cullen, Mr. Malcolmson and Dr. Benza, have pointed out the not yet fully explored path, which we hope will be examined by those who have opportunities of so doing. The exuviæ hitherto found in southern India have been exclusively confined to shells, but we know not why the remains of the higher orders of animals should not be met with. At any rate, it is a curious problem to unfold under what peculiar circumstances and at what eras, the formations of the Peninsula have been upheaved or deposited, that they should be exempted from appearances which are universally met with in other parts of the world. We have curtailed the following from the January number of the *Journal of the Asiatic Society of Bengal*, as we have not space to give the minute osteological descriptions. A representation of this singular relic, for which we are also indebted to the same publication, accompanies the text.—*Editor Madras Journal.*

* *Quarterly Review*, No. cx. p. 433. † Asiatic Researches, vol. 18. p. 13.
‡ Reports, 1832. p. 395.

The fossil which we are about to describe forms a new accession to extinct Zoology. This circumstance alone would give much interest to it. But in addition, the large size, surpassing the rhinoceros; the family of Mammalia to which it belongs; and the forms of structure which it exhibits; render the *Sivatherium* one of the most remarkable of the past tenants of the globe, that have hitherto been detected in the more recent strata.

Of the numerous fossil mammiferous genera discovered and established by Cuvier, all were confined to the Pachydermata. The species belonging to other families have all their living representatives on the earth. Among the Ruminantia, no remarkable deviation from existing types has hitherto been discovered, the fossil being closely allied to living species. The isolated position, however, of the Giraffe and the Camelidæ, made it probable, that certain genera had become extinct, which formed the connecting links between those and the other genera of the family, and further between the Ruminantia and the Pachydermata. In the Sivatherium* we have a ruminant of this description connecting the family with the Pachydermata, and at the same time so marked by individual peculiarities as to be without an analogue in its order.

The fossil remain of the Sivatherium, from which our description is taken, is a remarkably perfect head. When discovered, it was fortunately so completely enveloped by a mass of stone, that although it had long been exposed to be acted upon as a boulder in a water-course, all the more important parts of structure had been preserved. The block might have been passed over, but for an edging of the teeth in relief from it, which gave promise of something additional concealed. After much labour, the hard crystalline covering of stone was so successfully removed, that the huge head now stands out with a couple of horns between the orbits, broken only near their tips, and the nasal bones projected in a free arch, high above the chaffron. All the molars

* We have named the fossil, *Sivatherium,* from Siva, the Hindû, god, and *θηριον bellua.* The *Sivâlik* or Sub-Himâlayan range of hills, is considered in the Hindu mythology, as the *Lutiah* or edge of the roof of Siva's dwelling in the *Himâl aya,* and hence they are called the *Siva-ala* or *Sib-ala,* which by an easy transition of sound became the *Sewâlik* of the English. The fossil has been discovered in a tract which may be included in the *Sewâlik* range, and we have given the name of Sivatherium to it, to commemorate this remarkable formation so rich in new animals. Another derivation of the name of the hills, as explained by the *Mahant* or High Priest at *Dehra,* is as follows :

Sewâlik a corruption of *Siva-wâla,* a name given to the tract of mountains between the Jumna and Ganges, from having been the residence of Iswara Siva and his son Gane's who under the form of an Elephant had charge of the Westerly portion from the village of *Dûdhli* to the Jumna, which portion is also called *Gangaja, gaja* being in Hindi an Elephant. That portion Eastward from *Dûdhli,* or between that village and *Haridwâr,* is called *Deodhar,* from its being the especial residence of *Deota* or Iswara Siva : the whole tract however between the Jumna and Ganges is called *Siva-ala,* or the habitation of Siva : unde. der. *Sewâlik.*

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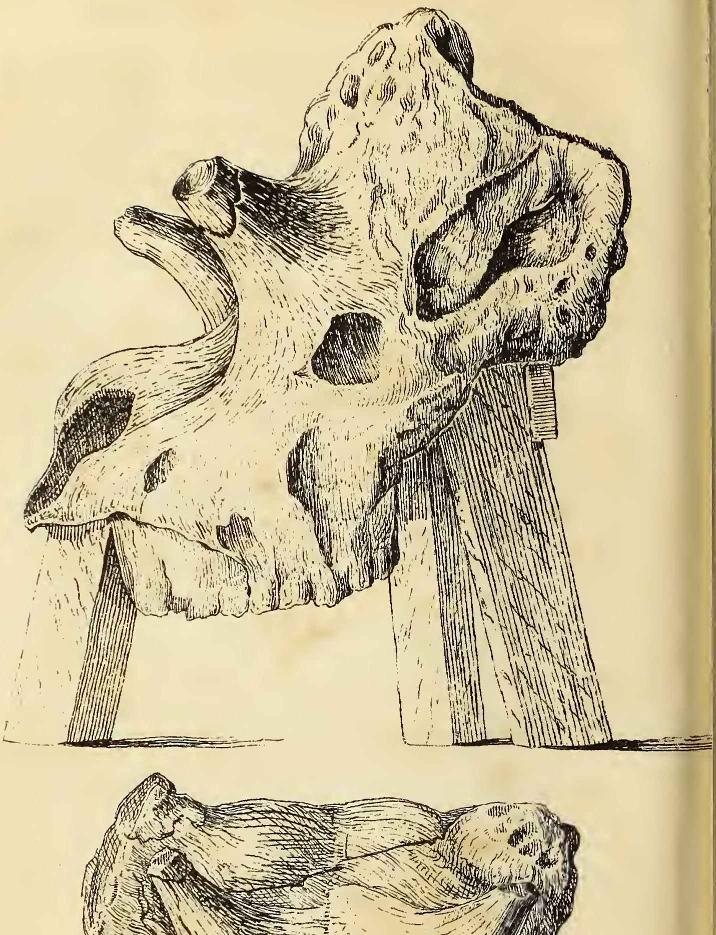
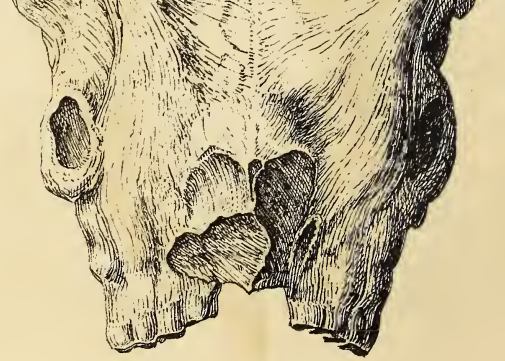
SIVATHERIUM

on a scale of one-seventh





GIGANTEUM.

of the original.

Fr[illegible] [illegible]sen Esq.[illegible] Capt. [illegible] [illegible] Asiatic Society of Bengal No. 49

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on both sides of the jaw are present and singularly perfect. The only mutilation is at the vertex of the cranium, where the plane of the occipital meets that of the brow: and at the muzzle, which is truncated a little way in front of the first molar. The only parts which are still concealed, are a portion of the occipital, the zygomatic fossæ on both sides, and the base of the cranium over the sphœnoid bone.

The form of the head is so singular and grotesque, that the first glance at it strikes one with surprise. The prominent features are—1st, the great size, approaching that of the elephant: 2d, the immense developement and width of the cranium behind the orbits: 3d, the two divergent osseous cores for horns starting out from the brow between the orbits: 4th, the form and direction of the nasal bones, rising with great prominence out of the chaffron, and overhanging the external nostrils in a pointed arch: 5th, the great massiveness, width and shortness of the face forward from the orbits: 6th, the great angle at which the grinding plane of the molars deviates upwards from that of the base of the skull.

Viewed in lateral profile, the form and direction of the horns, and the rise and sweep in the bones of the nose, give a character to the head widely differing from that of any other animal. The nose looks something like that of the rhinoceros; but the resemblance is deceptive, and only owing to the muzzle being truncated. Seen from in front, the head is somewhat wedge-shaped, the greatest width being at the vertex and thence gradually compressed towards the muzzle: with contraction only at two points behind the orbits and under the molars. The zygomatic arches are almost concealed, and nowise prominent: the brow is broad, and flat, and swelling laterally in two convexities; the orbits are wide apart, and have the appearance of being thrown far forward, from the great production of the frontal upwards. There are no crest or ridges: the surface of the cranium is smooth, the lines are in curves, with no angularity. From the vertex to the root of the nose, the plane of the brow is in a straght line, with a slight rise between the horns. The accompanying drawings will at once give a better idea of the form than any description.

There are six molars on either side of the upper jaw. The third of the series, or last milk molar, has given place to the corresponding permanent tooth, the detrition of which and of the last molar is well advanced, and indicates the animal to have been more than adult.

The teeth are in every respect those of a ruminant, with some slight individual peculiarities.

The three posterior or double molars are composed of two portions or semi-cylinders, each of which incloses, when partially worn down, a double crescent of enamel, the convexity of which is turned inwards. The last molar, as is normal in ruminants, has no additional complica-

tion, like that in the corresponding tooth of the lower jaw. The plane of grinding slopes from the outer margin inwards. The general form is exactly that of an ox or camel, on a large scale. The ridges of enamel are unequally in relief, and the hollows between them unequally scooped. Each semi-cylinder has its outer surface, in horizontal section formed of three salient knuckles,, with two intermediate sinuses; and its inner surface, of a simple arch or curve. But there are certain peculiarities by which the teeth dffier from those of other ruminants.

Dimensions of the Teeth.

	Length. *Inches.*	*Breadth.* *Inches.*
Last molar right side,	——	2.35
Penultimate do.	2.20	2.38
Antepenultimate do.	1.68	2 20
Last simple molar	1.55	2.24
Second do. do.	1.70	1.95
First do. do.	1.70	1.90

	Outer surfaces.	*Inner surfaces..*
Interval between the surfaces of last molar	9 9	5.5
do. do. do. third do.	9.8	4.5
do, do. do. second do.	8.4	4.5
do do. do. first do.	6.4	3,2

Space occupied by the line of molars 9.8 inches.

The form and relative proportions of the jaw agree very closely with those of the corresponding parts of a buffalo. The dimensions compared with those of the buffalo and camel are thus:

	Sivatherium.	*Buffalo.*	*Camel.*
Depth of the jaw from the alveolus last molar	4.95 inch.	2.65 inch.	2.70 inch.
Greatest thickness of do	2.3	1.05	1.4
Width of middle of last molar	1.35	0.64	0.76
Length of posterior ⅓d of do	2.15	0.95	1.15

No known ruminant, fossil or existing, has a jaw of such large size; the average dimensions above given being more than double those of a Buffalo, which measured in length of head 19.2 inches (.489 mètres); and exceeding those of the corresponding parts of the rhinoceros. We have therefore no hesitation in referring the fragment to the Sivatherium Giganteum.

The above comprises all that we know regarding the osteology of the head from an actual examination of the parts. We have not been so fortunate hitherto, as to meet with any other remain, comprising the anterior part of the muzzle either of the upper or lower jaw. We shall now proceed to deduce the form of the deficient parts, and the structure of the head generally, to the extent that may be legitimately inferred, from the data of which we are in possession.

Notwithstanding the singularly perfect condition of the head, for an organic remain of such enormous size, we cannot but regret the mutilation at the muzzle and vertex, as it throws a doubt upon some very interesting points of structure in the Sivatherium: 1st, the presence or absence of incisive and canine teeth in the upper jaw, and their number and character if present; 2nd, the number and extent of the bones which enter into the basis of the external nostrils; and 3rd, the presence or absence of two horns on the vertex, besides the two intra-orbital ones.

Regarding the first point, we have nothing sufficient to guide us with certainty to a conclusion, as there are ruminants both with and without incisives and canines in the upper jaw; and the Sivatherium differs most materially in structure from both sections. But there are two conditions of analogy which render it probable that there were no incisives. 1. In all ruminants which have the molars in a contiguous and normal series, and which have horns on the brow, there are no incisive teeth. In the camel and its congeners, where the anterior molars is unsymmetrical and separated from the rest of the series by an interval, incisives are present in the upper jaw. The Sivatherium had horns, and its molars were in a contiguous series: it is therefore probable that it had no incisives. Regarding the canines there is no clue to a conjecture, as there are species in the same genus of ruminants both with and without them. 2. The extent and connections of the incisive bones are points of great interest, from the kind of developement which they imply in the soft parts appended to them.

In most of the horned ruminantia, the incisives run up by a narrow apophysis along the anterior margins of the maxillary bones, and join on to a portion of the sides of the nasals; so that the bony basis of the external nostrils is formed of but two pairs of bones, the nasals and the incisives. In the camel, the apophysis of the incisives terminate upon the maxillaries without reaching the nasals, and there are three pairs of bones to the external nostrils, the nasals, maxillaries and incisives. But neither in the horned ruminants, nor in the camel and its congeners, do the bones of the nose rise out of the plane of the brow with any remarkable degree of saliency, nor are their lower margins free to any great extent towards the apex. They are long slips of bone, with nearly parallel edges, running between the upper borders of the maxillaries, and joined to the ascending process of the incisive bone, near their extremity, or connected only with the maxillaries; but in neither case projecting so as to form any considerable re-entering angle, or sinus, with these bones.

In our fossil, the form and connections of the nasal bones, are very different. Instead of running forward in the same plane with the brow, they rise from it at a rounded angle of about 130°, an amount of sali-

ency without example among ruminants, and exceeding what holds in the rhinoceros, tapir, and palæotherium, the only herbivorous animals with this sort of structure. Instead of being in nearly parallel slips, they are broad and well arched at their base, and converge rapidly to a sharp tip, which is hooked downwards, over-arching the external nostrils. Along a considerable portion of their length they are unconnected with the adjoining bones, their lower margins being free and so wide apart from the maxillaries, as to leave a gap or sinus of considerable length and depth in the bony parietes of the nostrils. The exact extent to which they are free, is unluckily not shown in the fossil, as the anterior margin of the maxillaries is mutilated on both sides, and the connection with the incisives destroyed. But as the nasal bones shoot forward beyond the mutilated edge of the maxillaries, this circumstance, together with their well defined outline and symmetry on both sides of the fossil, and their rapid convergence to a point with some convexity, leaves not a doubt that they were free to a great extent and unconnected with the incisives.

Now to determine the conditions in the fleshy parts, which the structure in the bony parietes of the nostrils entails.

The analogies are to be sought for in the ruminantia and pachydermata.

The remarkable saliency of the bones of the nose, in the Sivatherium, has no parallel, in known ruminants, to guide us; and the connection of the nasals with the incisives, or the reverse, does not imply any important difference in structure in the family. In the Bovine section, the Ox and the Buffalo have the nasals and incisives connected: whereas they are separate in the Yák* and Aurochs. In the Camel, they are also separate, and this animal has greater mobility in the upper lip than is found in other ruminants.

In the Pachydermata, both these conditions of structure are present and wanting in different genera; and their presence or absence is accompanied with very important differences in the form of the corresponding soft parts. It is therefore in this family that we are to look for an explanation of what is found in the Sivatherium.

In the Elephant and Mastodon, the Tapir, Rhinoceros, and Palæotherium, there are three pairs of bones to the external nostrils; the nasals, the maxillaries, and incisives†. In all these animals, the upper lip is highly developed, so as to be prehensile, as in the Rhinoceros, or extended into a trunk, as in the Elephant and Tapir; the amount of developement being accompanied with corresponding difference in the position and form of the nasal bones. In the Rhinoceros, they are long

* Cuvier. Ossemens Fossiles, tome iv. p. 131.
† Cuvier. Ossemens Fossiles, tome iii. p. 29.

and thick, extending to the point of the muzzle, and of great strength to support the horns of the animal: and the upper lip is broad, thick, and very mobile, but little elongated. In the Elephant, they are very short, and the incisives enormously developed for the insertion of the tusks, and the trunk is of great length. In the Tapir, they are short and free, except at the base, and projected high above the maxillaries; and the structure is accompanied by a well developed trunk. In the other Pachydermatous genera, there are but two pairs of bones to the external nostrils, the nasals and the incisives : the latter running up so as to join on with the former ; and the nasals, instead of being short and salient, with a sinus laterally between them and the maxillaries, are long, and run forward, united to the maxillaries, more or less resembling the nearly parallel slips of the Ruminantia. Of this genera, the Horse has the upper lip endowed with considerable mobility; and the lower end of the nasals is at the same time free to a small extent. In all the other genera, there is nothing resembling a prehensile organ in the upper lip.

In the Sivatherium, the same kind of structure holds, as is found in the Pachydermata with trunks. Of these it most nearly resembles the Tapir. It differs chiefly in the bones of the nose being larger and more salient from the Chaffron ; and in their being less width and depth to the nasomaxillary sinus, than the Tapir exhibits. But as the essential points of structure are alike in both, there is no doubt that the Sivatherium was invested with a trunk like the Tapir.

This conclusion is further borne out by other analogies, although more indirect than that afforded by the nasal bones.

1*st.*—The large size of the infra-orbitary foramen. In the fossil, the exact dimensions are indistinct, from the margin having been injured in the chiseling off of the matrix of stone : the vertical diameter we make out to be 1.2 inch, which perhaps may be somewhat greater than the truth ; but any thing approaching this size, would indicate a large nerve for transmission, and a highly developed condition of the upper lip.

2*d.*—The external plate of the bones of the cranium is widely separated from the inner, by an expansion of the diploe in vertical plates, forming large cells, as in the cranium of the Elephant: and the occipital is expanded laterally into alæ, with a considerable hollow between, as in the Elephant. Both these conditions are modifications of structure, adapted for supplying an extensive surface for muscular attachment, and imply a thick fleshy neck, with limited range of motion ; and, in more remote sequence, go to prove the necessity of a trunk.

3*d.*—The very large size of the occipital condyles, which are greater both in proportion, and in actual measurement, than those of the Ele-

phant, the interval between their outer angles, taken across their occipital foramen, being 7.4 inches. The atlas, and the rest of the series of cervical vertebræ, must have been of proportionate diameter to receive and sustain the condyles, and surrounded by a large mass of flesh. Both these circumstances would tend greatly to limit the range of motion of the head and neck. But to suit the herbivorous habits of the animal, it must have had some other mode of reaching its food ; or the vertebræ must have been elongated in a ratio to their diameter, sufficient to admit of free motion to the neck. In the latter case, the neck must have been of great length, and to support it and the load of muscles about it, an immense developement would be required in the spinal apophysis of the dorsal vertebræ, and in the whole interior extremity, with an unwieldy form of the body generally. It is therefore more probable that the vertebræ were condensed, as in the Elephant, and the neck short and thick, admitting of limited motion to the head : circumstances indirectly corroborating the existence of a trunk.

4th.—The face is short, broad, and massive, to an extent not found in the Ruminantia, and somewhat resembling that of the Elephant, and suitable for the attachment of a trunk.

Next with regard to the horns :—

There can be no doubt, that the two thick, short, and conical processes between the orbits, were the cores of horns, resembling those of the Bovine and Antilopine sections of the Ruminantia. They are smooth, and run evenly into the brow without any burr. The horny sheaths which they bore, must have been straight, thick, and not much elongated. None of the bicorned Ruminantia have horns placed in the same way, exactly between and over the orbits : they have them more or less to the rear. The only ruminant which has horns similar in position is the four-horned Antelope* of Hindustan, which differs only in having its anterior pair of horns a little more in advance of the orbits, than occurs in the Sivatherium. The correspondence of the two at once suggest the question, "had the Sivatherium also two additional horns on the vertex?" The cranium in the fossil is mutilated across at the vertex, so as to deprive us of direct evidence on the point, but the following reasons render the supposition at least probable :

1st.—As above stated, in the bi-cavicorned Ruminantia, the osseous cores are placed more or less to the rear of the orbits.

2d.—In such known species as have four horns, the supplementary pair is between the orbits, and the normal pair well back upon the frontal.

3d.—In the Bovine section of Ruminantia, the frontal is contracted behind the orbits, and upwards from the contraction, it is expanded

* The *Tetracerus* or *Antilope Quadricornis* and *Chekara* of authors.

again into two swellings, at the lateral angles of the vertex, which run into the bases of the osseous cores of the horns. This conformation does not exist in such of the Ruminantia as want horns, or as have them approximated on the brow. It is present in the Sivatherium.

On either supposition, the intra-orbitary horns are a remarkable feature in the fossil: and if they were a solitary pair on the head, the structure, from their position, would perhaps be more singular, than if there had been two additional horns behind.

Now to estimate the length of the deficient portion of the muzzle, and the entire length of the head:—

In most of the Ruminantia, where the molars are in a contiguous uninterrupted series, the interval from the first molar to the anterior border of the incisive bones is nearly equal to the space occupied by the molars; in some greater, in some a little less, and generally the latter. In other Ruminantia, such as the Camelidæ, where the anterior molars are insymmetrical with the others, and separated from them by being placed in the middle of the diasteme, this ratio does not hold; the space from the first molar to the margin of the incisives being less than the line of molars. In the Sivatherium, the molars are in a contiguous series, and if on this analogy we deduce the length of the muzzle, we get nearly 10 inches for the space from the first molar to the point of the incisives; and 28.85 inches for the whole length of the head, from the border of the occipital foramen to the margin of the incisives; these dimensions may be a little excessive, but we believe them not to be far out as the muzzle would still be short for the width of the face, in a ruminant.

The orbits next come to be considered. The size and position of the eye form a distinguishing feature between the Ruminantia and the Pachydermata. In the former, it is large and full, in the latter, smaller and sunken; and the expression of the face is more heavy in consequence. In the Sivatherium the horbit is considerably smaller in proportion to the size of the head than in existing ruminants. It is also placed more forward in the face, and lower under the level of the brow. The rim is not raised and prominent, as in the Ruminantia, and the plane of it is oblique; the interval between the orbits at their upper margin being 12.2 inches, and at the lower, 16.2 inches. The longitudinal diameter exceeds the vertical in the ratio of 5 to 4 nearly, the long axis being nearly in a line from the naso mixillary sinus across the hind limb of the zygomatic circle. From the above we infer that the eye was smaller and less prominent than in existing ruminants: and that the impression of the face was heavier and more ignoble, although less so than in the Pachydermata, excepting the horse; also that the direction of vision was considerably forwards, as well as lateral, and that it was cut off towards the rear.

This closes what we have been led to infer regarding the organs of the head. With respect to the rest of the skeleton, we have nothing to offer, as we are not at present possessed of any other remains which we can with certainty refer to the Sivatherium. Among a quantity of bones* collected from the same neighbourhood with the head fossil, there are three singularly perfect specimens of the lower portions of the extremities of a large ruminant, belonging to three legs of one individual. They greatly exceed the size of any known ruminant, and excepting the Sivatherium Giganteum, there is no other ascertained animal of the order, in our collection, of proportionate size to them. We forbear from further noticing them at present, as they appear small in comparison for our fossil: and besides, there are indications in our collection, in teeth and other remains, of other large ruminants, different from the one we have described.

The form of the vertebræ, and more especially of the carpi and tarsi, are points of great interest, to be ascertained; as we may expect modifications of the usual type adapted to the large size of the animal. From its bulk and armed head, few animals could be strong enough to contend with it, and we may expect that its extremities were constructed more to give support, than for rapidity of motion. But, in the rich harvest which we still hope to reap in the valleys of the *Markanda*, it is probable that specimens to illustrate the greater part of the osteology of the Sivatherium will at no very distant period be found.

The structure of the teeth suggests an idea regarding the peculiarities of the herbivorous habits of the animal. In the description it was noticed that the inner central plate of enamel ran in a flexuous sweep, somewhat resembling what is seen in the Elasmotherium, an arrangement evidently intended to increase the grinding powder of the teeth. It may hence be inferred, that the food of the Sivatherium was less herbaceous than that of existing horned ruminants, and derived from leaves and twigs: or that as in the horse, the food was more completely masticated, the digestive organs less complicated; the body less bulky, and the necessity of regulation from the stomach less marked than in the present Ruminantia.

The following dimensions, contrasted with those of the Elephant and Rhinoceros, will afford a tolerably accurate idea of the size of the Sivatherium. They are characteristic, although not numerous:—

* We note here a very perfect cervical vertebræ of a Ruminant in our possession, which must have belonged to an animal of proportions equal to that of the Sivatherium, but from certain characters, we are inclined to suspect that it is allied to some other gigantic species of Ruminant, of the existence of which we have already tolerable certainty. Of the existence of the Elk, and a species of Camelidæ, Lieut. Baker of the Engineers has shewn us ample proof.

	Elephant.	Sivatherium.	Indian 1-horned Rhinoceros.
From margin of foramen magnum to the first molar,	23.10 inch.	18.85 inch.	24.9 inch.
Greatest width of the cranium,	26.0	22.0	12.05
Do. do. of face between the malar bones,	18.5	16.62	9.20
Greatest depth of the skull,	17.80	11.9	11.05
Long diameter of the foramen magnum,	2.55	2.6	2.65
Short........do........do........do..	2.4	2.3	1 5
Average of the above,	15.06	12.38	10.22

If the view which we have taken of the fossil be correct, the Sivatherium was a very remarkable animal, and it fills up an important blank in the interval between the Ruminantia and Pachydermata. That it was a ruminant, the teeth and horns most clearly establish; and the structure which we have inferred of the upper lip, the osteology of the face, and the size and position of the orbit, approximate it to the Pachydermata. The circumstance of any thing approaching a proboscis is so abnormal for a ruminant, that at the first view, it might raise a doubt, regarding the correctness of the ordinal position assigned to the fossil; but when we inquire further, the difficulty ceases.

In the Pachydermata, there are genera with a trunk, and others without a trace of it. This organ is therefore not essential to the constitution of the order, but accidental to the size of the head, or habits of the animal in certain genera. Thus in the Elephant, nature has given a short neck to support the huge head, the enormous tusks and the large grinding apparatus of the animal; and by such an arrangement, the construction of the rest of the frame is saved from the disturbance which a long neck would have entailed. But as the lever of the head became shortened, some other method of reaching its food became necessary; and a trunk was appended to the mouth. We have only to apply analagous conditions to a ruminant, and a trunk is equally required. In fact, the Camel exhibits a rudimentary form of this organ, under different circumstances. The upper lip is cleft; each of the divisions is separately movable and extensible, so as to be an excellent organ of touch.

The fossil was discovered near the *Markanda* river, in one of the small valleys which stretch between the *Kyárda-dún* and the valley of *Pinjór*, in the *Sivâlik* or sub-Himálayan belt of hills, associated with bones of the fossil Elephant, Mastodon, Rhinoceros, Hippopotamus, &c. So far as our researches yet go, the Sivatherium was not numerous. Compared with the Mastodon and Hippopotamus, (*H. Siválensis*, Nobis, a new species characterized by having six incisors in either jaw;) it was very rare.

Northern Doáb, Sept. 15, 1835.

ON THE HINDU ASTRONOMICAL TABLES.

(From the Edinburgh New Philosophical Journal, Jan. 1836.*)*

There is a very singular revival of a justly exploded opinion of the character of these tables, in the published proceedings of the Anniversary Meeting of the Royal Asiatic Society, held on Saturday 9th May 1835, appended to the journal of that Society.

Few persons at all conversant with the recent progress of science and literature, are ignorant of the opinions of Bailly and Playfair on this subject, and of the advantage that some persons took of them to propagate, with great zeal, a total scepticism respecting the authenticity of the true records of mankind, which we possess in Europe, the acknowledged chronology of these not agreeing with such an early advance of science in India. It was in vain that Mr. Jones had early demonstrated the true nature of the Hindu Tables, in opposition to the opinion of Bailly and Playfair. By a certain class of writers, they were held forth as a faithful record of actual observations, for many years after the death of Bailly. In the Edinburgh Review, especially, as if some writer in that work had taken the opinion of Bailly and Playfair under his special protection, we had a series of papers taking the accuracy of that opinion for granted, down to the very time when the question was finally set at rest in Laplace's Système du Monde.

Sir Alexander Johnston, as we learn from a note appended to the report of the Anniversary Meeting, has been requested to reduce his observations to writing; and it is to be hoped may correct the oversight, in the published report, of the lucid statement of Laplace. It is the object of the Royal Asiatic Society, as we learn from Sir Alexander Johnston's speech, to diffuse European learning and science in India; but the young gentlemen whom we send out thither with that view, would be less stimulated to their noble task, and especially could feel no interest in the introduction among the Hindus of that which is infinitely more valuable than human learning and science, and that is our revealed Theology and Ethics, were they to leave our shores infested with any degree of the scepticism appended to the opinion of Bailly and Playfair, and go into regions where they could have little opportunity for correcting that erroneous opinion.

What follows is copied from Harte's translation of the Systême du Monde, vol. ii. pp. 220, 221, 222 (Dublin 1830). The demonstrations are too varied, complete, and consistent, to leave any doubt that the Hindu Tables are the result, not of observation, but of erroneous calculation backwards to anterior time.

"In Persia and India," says Laplace, " the commencement of astronomy is lost in the darkness which envelopes the origin of these people.

" The Indian tables indicate a knowledge of astronomy considerably advanced, but every thing shews that it is not of an extremely remote

antiquity. And here, with regret, I differ in opinion from a learned and illustrious astronomer, whose fate is a terrible proof of the inconstancy of popular favour, who, after having honoured his career by labours useful both to science and humanity, perished a victim to the most sanguinary tyranny, opposing the calmness and dignity of virtue, to the revilings of an infatuated people, of whom he had been once the idol.

" The Indian tables have two principal epochs which go back, one to the year 3102, the other to the year 1491, before our era. These epochs are connected with the mean motions of the sun, moon, and planets, in such a manner, that, setting out from the position which the Indian tables assign to all the stars at this second epoch, and reascending to the first by means of these tables, the general conjunction which they suppose at this primitive epoch is found. Bailly, the celebrated astronomer, already alluded to, endeavours, in his Indian Astronomy, to prove that the first of those epochs is founded on observation. Notwithstanding all the arguments are brought forward with that perspicuity he knew so well to bestow on subjects the most abstract, I am still of opinion, that this period was invented for the purpose of giving a common origin to all the motions of the heavenly bodies in the zodiac. Our last astronomical tables being rendered more perfect by the comparison of theory with a great number of observations, do not permit us to admit the conjunction supposed in the Indian tables; in this respect, indeed, they made much greater differences than the errors of which they are still susceptible, but it must be admitted that some elements in the Indian astronomy have not the magnitude which they assigned to them, until long before our era; for example, it is necessary to ascend 6000 years back to find the equation of the centre of the sun. But, independently of the errors to which the Indian observations are liable, it may be observed, that they only considered the inequalities of the sun and moon relative to eclipses, in which the annual equation of the moon is added to the equation of the centre of the sun, and augments it by a quantity which is very nearly the difference between its true value and that of the Indians. Many elements, such as the equation of the centre of Jupiter and Mars, are very different in the Indian tables from what they must have been at their first epoch.

" A consideration of all these tables, and particularly the impossibility of the conjunction at the epoch they suppose, prove, on the contrary, that they have been constructed, or at least rectified, in modern times. This also may be inferred from the mean motions which they assign to the moon, with respect to its perigee, its nodes, and the sun, which, being more rapid than according to Ptolemy, indicate that they are posterior to this astronomer; for we know, by the theory of universal gravitation, that these three motions have accelerated for a great number of ages."

Note on the Magnesite.—By the Editor.

(See page 24.)

Mr. Chamier, Chief Secretary to Government, has obligingly favoured us with a perusal of Dr. Macleod's Report to Government, referred to by Dr. Benza, but it alludes only to the properties of the Magnesite as a cement, and gives no account of its chemical analysis, for which a reference is made to that given by Mr. Henry, who first analysed the Indian mineral.

We subjoin an extract from the most modern work on Chemistry, together with the account of Mr. James Prinsep's investigations on this subject, which will inform our readers of every particular necessary to be known.

" *Carbonate of Magnesia.*—It is met with occasionally in small acicular crystals, and in a pulverulent earthy state, but more commonly as a compact mineral of an earthy fracture called magnesite. A specimen of magnesite from the East Indies, where I am informed it is abundant, has been analysed by Dr. Henry, who found it to be nearly pure anhydrous carbonate of magnesia: it is of a snow-white colour, of density 2·56, and so hard that it strikes fire with steel. (An. of Phil. xvii. 252). It is obtained in minute transparent hexagonal prisms with 3 eq. of water, when a solution of bicarbonate of magnesia evaporates spontaneously in an open vessel. The crystals lose their water and become opaque by a very gentle heat, and even in a dry air at 60°. By cold water they are decomposed, yielding a soluble bicarbonate and an insoluble white compound of hydrate and carbonate of magnesia; and hot water produces the same change with disengagement of carbonic acid, without dissolving any magnesia. (Berzelius.)"*

Analysis of Native Carbonate of Magnesia from South India.

By James Prinsep, Esq.

" In my analysis of the Nerbudda dolomite, published in the *Gleanings in Science*, vol. I. p. 267, I expressed a desire to obtain some of this mineral, stated by Dr. Thompson to form " whole rocks in Hindustan, and to contain much less carbonic acid than it ought," though he was curious to know whether the interior portions of the mountain might not have their full proportion."

" My wish has at length been gratified by Dr. Malcolmson, Secretary Medical Board at Madras, among whose specimens, recently presented to the Society, are several lumps of this curious mineral. Dr. M. writes : " The native carbonate of Magnesia from Salem has again attracted attention. I at first supposed it to be a Magnesite, from

* Turner's *Elements of Chemistry*, p. 738.

the great difficulty of dissolving it, but subsequent observation proved it to contain no silex. Its composition would seem to be, carbonic acid, 47·5; water 4·0*; magnesia 48·5. As it is likely to become an article of commerce, and the statements regarding it are contradictory, I send some for your re-examination. It occurs in thin veins (from an inch to a foot), and also, (it is said,) in beds."

" As the atomic weight of magnesia differs materially in different chemical works, I was anxious to make use of this mineral to set the mineral at rest, and decide whether Berzelius, Thomson, or Brande was most to be trusted.

" Three careful experiments proved, that the water contained was 0·8 per cent., while the slight adulteration of silica left, on dissolving 100 grains, was only 0·3; traces of alumina and oxide of iron were visible in the form of a delicate brown gelatinous film on adding ammonia to the solution, but none of lime, even after adding sulphuric or oxalic acid, evaporating to dryness, and re-dissolving in distilled water. The solid impurities, therefore, being set against the gaseous, as nearly in the proportions of the magnesian salt itself, it is evident, that simple calcination of the solid mineral will give a very exact view of its constituent proportions.

" Ten specimens of 100 grains each, treated in this manner, returned from the fire, weighing respectively, 49.67, 48.26, 48.20, 48.40, 48.40, 48.38, 48.39, 48.33, 48.37, and 48.33. The first of these was in the solid form, and therefore may not have been thoroughly calcined: the average of the rest gives,

Magnesia	48.34 by Berzelius	48.31†
Carbonic acid	51.66	51.69
	100	100

or almost precisely the composition according to this accurate chemist —which it may be remembered was the only one which would agree with my analysis of the Jabalpur dolomite, a definite crystallized compound of one atom of carbonate of lime and one of magnesia.

" To prove that no influential quantity of carbonic acid was retained, two of the specimens, were dissolved in dilute nitric acid, in a closed glass tube—the gas extricated was less than the 50th of a cubic inch.

" The mineral was found to differ considerably in weight from the statements of Thomson and Phillips—the specific gravity of two

* Dr. Malcolmson afterwards corrects this error. A part of the carbonic acid was driven off with the water.

† By Dr. Thomson, M. 46.2 C. A. 53.8; by Brande M. 47.2; C. A. 52.8.

specimens being 2·970, and 2·897, at the temperature of 85°. A good deal of air was given off on its first immersion into water, and it adhered to the tongue.

" Another point to be ascertained, from this mineral, was, whether the circumstance I noticed on the occasion alluded to, would hold true, viz. that calcined magnesia would not become a hydrate, like lime, on slaking, and that this earth might thus be recognized in mixtures.

" Three of the calcined specimens were treated with water, which disengaged considerable heat, and then exposed in a receiver, over concentrated sulphuric acid, to be ridden of hygrometric moisture. After thirty hours, they weighed respectively 60·45, 58·7, 60·9 grs., shewing an average excess of 10·0, which is about half an atom of water (9·8). This result is so unexpected that it requires further examination, which I hope to be able to give hereafter."*

With regard to the minerals found associated with the magnesite, we have been favoured by Mr. Fischer, of Salem, with a series of specimens, in which chromate of iron and chèrt are found, both stated by that gentleman to be very abundant in the magnesite formation.

Mr. Gilchrist of Hoonsoor, informs us that he has discovered a formation of magnesite in that neighbourhood, of which a description and specimens are promised us—so that it would seem the localities of this mineral are numerous in southern India.

M. A. Brongniart thus classifies the magnesite found in Europe. †

" 1. Plastic Magnesite (magnèsite plastique), composed of magnesia, silex and water, without carbonic acid.

" I here comprise the magnesite so improperly named écume de Mer, that of the environs of Madrid, that of the environs of Paris, that of Salinelle, department of the Gard, &c.

Serpentine might, from its composition, almost be referred to this species ; but it is distinguished from it by its Mineralogical characters.

" 2. Effervescent Magnesite (magnésite effervescente), essentially composed of magnesia and carbonic acid, sometimes associated with very variable proportions of silex and water.

" We may refer to this division the magnesite of Hroubschitz in Moravia : those of Piedmont, of the isle of Elba, of Baumgarten in Silesia, of Styria, &c."

* *Journal of the Asiatic Society of Bengal*, No. 45, p, 510,

† Geological Memoirs, translated by Mr. De la Beche, p. 283.

Hourly Meteorological Observations made at the Honorable East India Company's Observatory, at Madras.

1836.		Barometer.	Thermo-meter.	Depth of w. b. Ther.	Wind.	Clouds.	Remarks.
		Inches	°	°			
June 21	6 A.M.	29,850	83,5	11,0	w. by s.	10	Wind just perceptible.
	7	,858	84,3	11,3	w. by s.	9	Do. a little stronger.
	8	,872	86,0	13,0	w. s.w.	5	A little breeze.
	9	,900	87,1	14,0	w. s.w.	4	Hazy do. do.
	10	,907	89,7	15,7	w. s.w.	2	Do. do. do.
	11	,898	92,0	18,5	w. s.w.	1	A fresh breeze.
	12	,884	93,7	19,5	w.	3	Hazy—gentle breeze,
	1 P.M.	,883	96,3	20,4	s. w. & s.	4	Do. do. do.
	2	,854	95,8	20,9	s.	6	Do. do. do.
	3	,840	90,0	12,4	s.E.	7	Do. gentle wind.
	4	,832	87,8	10,6	s. s.E.	7	Fresh breeze.
	5	,820	85,8	7,4	s.	8	Do. do.
	6	,815	84,7	5,7	s. s.E.	10	There have been a few drops of rain during the last hour.
	7	,820	84,1	6,0	s. by E.	10	Gentle breeze.
	8	,828	84,2	5,0	s. s.w.	10	Strong wind.
	9	,842	85,3	10,3	s. s.w.	9	Do. do.
	10	,850	85,0	10,0	s.w.	8	Gentle wind.
	11	,852	84,6	9,4	s.w.	9	Do. do.
	12	,857	84,7	9,2	s.w.	5	Do. do.
22	1 A.M.	,853	84,5	9,2	s.w.	3	Do. do. hazy
	2	,843	86,0	12.7	s.w.	9	Strong wind.
	3	,834	85,6	12,1	w. s.w.	7	Gentle breeze.
	4	,820	85,0	10,8	w. s.w.	3	Do.
	5	,829	83,6	11,1	w. s.w.	8	Do.
	6	,846	83,5	11,3	s.w.	6	Do.
	7	,866	84,3	10,7	w. s.w.	5	Do.
	8	,884	87,6	14,7	w. s.w.	6	Strong wind.
	9	,892	88,3	13,4	w. s.w.	5	Do.
	10	,884	90,5	16,9	w. by s.	6	Do.
	11	,837	93,2	18,9	w. by N.	4	Fresh breeze.
	12	,872	94,7	20,3	w. by s.	5	Fresh wind.
	1 P.M.	,856	95,1	20,0	w. by s.	6	Do.
	2	,822	96,7	20,2	w.	7	Gentle wind.
	3	,810	95,2	20,8	w.	7	Do.
	4	,794	94,9	17,5	w.	7	Do.
	5	,800	93,5	17,5	w.	10	Do.
	6	,813	92,0	17,0	N.w.by N.	10	Do. and some drizzling rain.

The foregoing observations were made with a standard Barometer by Gilbert, which requires the correction +,051 inches for capillary action and —,006 inches for zero error; in addition to which the usual reduction to a standard temperature of 32°, or otherwise, remains to be applied. The Thermometer is a standard one, constructed by Troughton, and differs insensibly from the standard belonging to the Royal Society. The instruments were placed in the Western verandah of the Observatory, where they were sheltered from the direct action of the Sun and radiation, but otherwise well disposed for accurate determinations.

T. G. TAYLOR,
H. C.'s Astronomer.

*** We have great pleasure in being able to comply with the recommendation of the Meteorological Committee of the South African Literary and Philosophical Institution, in submitting the foregoing table for the days appointed by them for simultaneous horary observation throughout the world, and we hope to repeat it at the prescribed intervals.—*Editor.*

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF MARCH 1836.

	Standard Barometer No. 3 by Gilbert.							Standard Thermr. by Troughton.							Dep. of wet bulb Thermr.			Rain.		Evaporation.	Wind.			REMARKS.		
	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	Noon.	Sun set.	Sun rise.	Sun set.		Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	o	o	o	o	o	o	o	o	o	o	In.	In.	In.						
Mar. 1	30,028	30,108	30,094	30,060	30,038	30,056	30,066	63,0	76,9	80,0	80,9	79,1	74,9	71,4	3,6	11,7	7,1			1,965	S.	SE.		Clear	Clear	Clear.
2	,060	,124	,106	,088	,078	,114	,118	62,3	76,0	79,4	80,2	78,3	77,0	77,0	2,8	9,1	6,9				S.	SE.		do	do	do
3	,102	,146	,126	,116	,096	,134	,128	67,6	78,2	80,0	80,6	79,0	78,0	76,0	4,0	9,2	8,8				E.	SE.		do	do	do
4	,100	,150	,128	,088	,082	,106	,110	67,0	79,0	80,1	81,5	78,0	77,8	74,9	2,7	10,8	8,5				E.	SE.	NE.	do	do	do
5	,096	,122	,110	,088	,066	,096	,104	63,0	78,0	77,6	80,7	79,5	77,9	73,0	5,0	5,1	—				E.	SE.	S.	do	do	do
6	,076	,140	,108	,096	,084	,100	,112	66,0	78,7	79,6	80,3	79,9	78,2	74,3	3,4	6,2	4,4				E.	SE.	S.	do	do	do
7	,088	,132	,122	,098	,088	,104	,116	65,0	79,3	80,6	81,4	79,5	77,9	76,8	3,4	—	9,3				S.	SE.	E.	do	do	do
8	,104	,132	,116	,090	,072	,080	,102	65,7	78,1	81,5	81,8	80,4	79,5	78,4	3,2	10,1	6,4			1,792	SE.	S.		do	do	do
9	,102	,118	,114	,094	,069	,076	,094	70,1	80,6	82,4	83,3	80,8	79,1	78,2	4,1	5,7	6,5				SE.	S.	SW.	do	do	do
10	,088	,120	,098	,070	,060	,062	,102	68,0	80,6	82,7	83,0	81,0	79,0	77,9	4,8	7,9	6,2				SW.	S.	SW.	do	do	do
11	,082	,122	,106	,064	,070	,102	,100	67,2	79,9	81,8	82,4	80,8	77,8	77,3	3,8	8,8	9,9				SW.	SE.		do	do	do
12	,068	,106	,094	,064	,046	,062	,082	63,0	78,8	81,2	81,7	79,2	77,8	74,0	2,9	8,5	7,0				E.	SE.		do	do	do
13	,050	—	,086	,040	,030	,046	,050	68,0	—	81,6	82,0	80,1	79,0	74,7	2,0	7,3	6,1				SE.	S.		do	do	do
14	,042	,088	,074	,030	,014	,032	,052	68,9	78,7	81,3	81,4	79,9	76,2	73,0	3,6	8,9	7,8				S.	SE.		do	do	do
15	,052	,120	,100	,076	,064	,086	—	65,7	80,9	82,8	83,4	81,0	79,9	—	5,6	8,8	5,7			2,062	S.	SE.	E.	do	do	do
16	,100	,122	,110	,086	,082	,098	,114	69,9	79.8	81,7	81,8	80,2	79,0	77,6	5,0	9,1	10,0				S.	SE.	E.	do	do	do
17	,104	,138	,120	,106	,094	,104	,108	66,0	79,0	81,8	82,3	80,8	77,2	73,3	5,0	12,1	9,5				SE.	E.	S.	do	do	do
18	,096	,110	,112	,090	,068	,090	,102	63,7	79,1	80,8	82,4	80,0	79,0	78,3	6,7	8,5	7,3				E.	SE.	S.	Clear	F. C.	Clear.
19	,102	,116	,114	,096	,070	,090	,106	67,8	80,1	81,6	82,2	81,0	79,9	79,2	5,3	10,1	7,7				SE.	E.	S.	do	do	do
20	,108	—	,116	,090	,074	,084	,098	72,1	—	83,4	83,7	82,0	80,8	80,2	4,2	7,9	6,0				SE.	E.	S.	do	do	do
21	,102	,118	,096	,050	,024	,046	,074	74,7	83,0	84,8	85,0	83,2	81,1	80,8	3,8	9,0	6,8				SE.	E.	S.	do	do	do
22	,078	,094	,062	,052	,046	,020	,050	78,0	84,5	86,0	85,8	83,0	81,2	81,0	4,1	8,0	5,5			2,271	SE.	S.		Clear	Clear	Cloudy
23	,058	,098	,076	,050	,020	,028	,050	78,9	83,8	85,5	86,3	83,8	81,9	81,3	4,5	6,8	5,0				SW.	W.	S.SE	do	do	do
24	,052	,082	,048	,064	,020	,050	—	79,5	85,0	85,8	80,4	80,2	81,6	—	3,7	6,6	6,3				S.SE	E.	NE.N	F. C.	Clear	Cloudy
25	,100	,124	,112	,074	,064	,088	,102	76,0	81,0	83,4	84,8	82,7	81,1	[illegible]0,4	6,2	11,1	8,8				NE.	E.	SE.	Clear	Clear	P. C.
26	,110	,144	,120	,102	,086	,086	,098	76,8	83,1	84,1	84,9	82,3	81,3	81,0	6,0	8,4	7,5		0,149		SE.			do	do	do
27	,090	—	,108	,086	,066	,072	,090	77,8	—	83,7	84,6	82,2	81,4	[illegible]0,8	5,2	8,5	7,6				SW.	S.	SE.	do	do	do
28	,100	,118	,108	,080	,062	,084	,100	71,5	82,3	83,7	84,0	82,3	81,3	[illegible]0,9	5,1	7,9	7,4				NW.	SW.	SE.	do	do	do
29	,10[illegible]	,134	,122	,088	,080	,096	,11[illegible]	73,4	83,0	84,0	84,9	82,[illegible]	80,8	80,3	3,3	9,0	8,8			2,483	SW.	SE.	SE.	do	do	do
30	,09	,112	,094	,082	,044	30,046	,052	69,6	82,0	83,2	84,[illegible]	81,9	80,9	7[illegible]	6,6	9,0	8,4				W.	S.	SW.	do	do	do
31	,0[illegible]8	,060	,050	,012	,000	29,996	,022	70,7	82,5	84,2	84,8	82,0	81,0	80,[illegible]	6,2	8,8	7,1				SW.	S.	E.	do	do	do
Mean.	30,083	30,118	30,102	30,076	30,060	30,075	30,090	69,6	80,4	82,3	82,8	80,9	79,3	77,7	4,4	8,6	7,3									

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF APRIL 1836.

	Standard Barometer No. 3 by Gilbert.							Standard Thermometer by Troughton.							Depth of wet bulb Therm.			Rain.		Evaporation.	Wind.			Remarks.		
	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	Noon.	Sun set.	Sun rise.	Sun set.		Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	o	o	o	o	o	o	o	o	o	o	In.	In.	In.						
Apr. 1	30,010	30,056	30,038	30,010	30,002	30,024	30,044	71,8	82,1	83,4	84,0	82,0	81,3	80,2	3,1	8,5	7,1				W.	SE.	SE.	Clear	Clear	Clear
2	,050	,096	,080	,058	,038	,050	,064	72,0	83,0	83,8	84,8	82,8	81,4	81,0	5,1	10,0	8,0				W.	SE.	E.	do	do	F. C.
3	,078	—	,100	,076	,054	,074	,076	73,7	—	85.7	86,3	83,7	83,0	82,7	5,8	9,7	6,7				W.	E.	SE.	do	do	do
4	,068	,100	,100	,074	,048	,060	,080	78,5	84,8	86,2	86,8	84,0	32,9	82,3	4,7	8,2	6,8				SE.	SE.	SE.	do	Haze	Haze
5	054	,094	,088	,044	,004	,018	,050	76,8	85,3	86,1	86,3	84,1	82,6	81,8	4,5	8,8	6,2				SE.	SE.	SE.	do	Clear	Clear
6	,000	,080	,058	,028	29,996	,020	,048	76,0	85,1	86,4	86,3	84,3	82,7	82,3	4,3	7,9	5,8			2,500	SW.	SE.	S.	do	do	do
7	,056	,094	,068	,044	30,046	,064	,080	77,8	86,1	86,6	86,7	84,1	82,9	82,3	5,0	8,2	5,7				S.	SE.	S.	Th. haze	Haze	Haze
8	,100	,112	,100	,084	,040	,060	,074	76,2	85,2	86,8	86,7	84,4	84,1	82,8	4,2	8,4	6,2				SW.	S.	SE.	Clear	Clear	do
9	,084	,094	,070	,022	,012	,038	,040	74,9	84,9	85,0	86,8	84,1	81,9	81,7	4,9	9,9	7,3				NW.	S.	SE.	do	do	Haze
10	,060	—	,080	,066	,046	,064	,076	76,6	—	84,7	85,8	83,5	82,0	81,0	3,9	8,4	—				SW.	SE.	SE.	do	do	Clear
11	,086	,132	,122	,082	,078	,096	,098	72,0	83,2	84,9	85,8	84,0	82,2	79,0	3,9	9,7	—				NW.	SE.	SE.	do	do	do
12	,092	,104	,094	,054	,038	,034	,058	72,0	83,1	86,2	87,7	84,1	82,0	79,5	6,2	9,4	7,2				SW.	S.	SE.	do	do	do
13	,030	,044	,012	29,972	29,966	29,976	29,988	69,4	85,0	87,6	87,8	84,8	82,9	81,6	5,3	10,1	8,8			2,521	SW.	SE.	S.	do	do	do
14	29,978	,018	,008	29,972	,972	,968	,972	73,2	85,5	85,0	85,5	82,9	82,0	82,0	4,5	8,0	4,9				S.	SE.	S.	do	do	do
15	,996	,070	,042	30,014	,988	30,002	30,028	74,5	85,0	86,3	86.8	84,1	82,8	82,1	4,0	8,9	6,1				S.	S.	SE.	do	do	do
16	30,050	,088	,086	,046	30,022	,052	,054	76,0	85,3	86,0	86,0	84,0	82,4	81,8	2,4	7,7	5,8				SW.	SE.	SE.	do	Haze	Haze
17	,060	,066	,075	,056	,022	,030	,049	75,2	85,0	86,0	86,4	84,7	83,1	82,5	3,8	6,9	5,1				SW.	SE.	S.	F. C.	Clear	Clear
18	,046	,080	,070	,048	,002	,028	,030	73,1	84,1	85,9	86,4	84,0	82,8	82,6	4,1	8,1	6,8				SW.	SE.	S.	Clear	do	do
19	,042	,052	,052	,030	29,978	29,992	,006	73,5	84,3	86,8	86,4	76,9	76,8	82,0	4,5	9,6	7,4				SE.	SE.	S.	do	do	do
20	,016	,058	,050	,038	,998	30,006	29,990	74,1	84,9	86,0	87,0	83,5	82,6	82,6	4,9	8,3	6,5			2,743	SW.	SE.	SE.	Haze	Haze	do
21	,014	,064	,050	,010	,970	,000	30,002	74,2	84,8	86,5	86,8	84,2	82,6	82,3	4,2	8,8	6,5				SE.	SE.	S.	do	do	Haze
22	,014	,050	,040	,002	,954	29,978	30,002	75,0	86,0	87,0	87,1	83,7	82,8	82,2	4,3	9,4	6,2				SW.	SE.	S.	do	Clear	Clear
23	29,970	,012	29,998	29,966	,944	,950	29,976	74,3	85,9	86,8	87,4	84,2	82,9	81,9	4,1	9,4	6,4				S.	S.	S.	Clear	do	do
24	,982	—	30,012	,962	,918	,926	,962	80,0	—	87,0	87,6	84,9	83,0	82,0	4,5	9,4	5,4				SE.	SE.	S.	do	do	do
25	,968	,022	,004	,980	,952	,962	,978	77,8	86,3	87,5	87,4	84,9	82,7	81,9	3,5	8,0	5,4				S.	S.	S.	do	do	do
26	,980	,032	,010	,972	,946	,960	,988	76,0	85,8	86,6	87,0	85,2	83,3	82,3	4,0	9,0	6,2				SW.	SE.	S.	do	do	do
27	,996	,042	,080	30,060	,962	30,004	30,020	75,3	86,2	86,3	86,6	83,2	83,4	81,3	4,4	10,3	4,3			2,757	S.	SE.	S.	do	do	Haze
28	,996	,042	,034	29,992	,956	29,966	29,970	74,0	85,3	87,5	86,6	84,9	78,0	81,7	4,7	9,5	5,9				N.	SE.	SE.	Haze	Haze	Clear
29	,960	29,984	29,976	,958	,916	,924	,938	77,0	85,5	87,3	87,7	84,6	83,1	82,4	5,0	8,7	5,1				SW.	SE.	S.	do	do	Haze
30	,942	,950	,944	,910	,902	,904	,916	75,9	86,2	87,7	88,4	84,7	82,2	81,8	3,8	9,0	5,4				SW.	S.	S.	Clear	Clear	Clear
Mean	30,033	30,061	30,051	30,021	29,992	30,007	30,022	74,9	84,8	86,2	86,6	83,8	82,5	81,8	4,4	8,9	6,3									

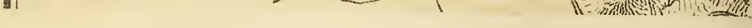
METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF MAY 1836.

	Standard Barometer No. 3 by Gilbert.							Standard Thermr. by Troughton.							Dep. of wet bulb Thermr			Rain.		Evaporation.	Wind.			Remarks.		
	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	Noon.	Sun set.	Sun rise.	Sun set.		Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	0	0	0	0	0	0	0	0	0	0	In.	In.	In.						
May 1	29,936	29,938	29,996	29,964	29,942	29,958	29,966	75,9	85,3	86,9	87,0	84,4	83,0	81,5	4,7	9,5	6,1				SW.	SE.	SE.	Clear	Clear	Clear
2	,988	30,000	30,002	,984	,977	,988	,996	71,7	84,2	85,0	86,0	83,4	82,8	81,0	4,9	7,7	5,4				SW.	SE.	S.	do	do	do
3	,988	30,004	30,006	,972	,942	,950	——	75,8	85,9	87,5	88,0	85,7	77,8	——	5,0	10,9	5,8				S.	S.	SE.	Haze	do	Haze
4	,964	30,014	30,002	,954	,936	,954	,960	79,7	86,8	89,7	89,0	85,7	85,3	83,1	3,8	12,1	5,1			2,562	S.	SW.	S.	do	Th. Haze	do
5	,954	30,006	29,976	,932	,914	,928	,926	79,9	88,9	90,2	90,2	86,0	84,7	84,0	3,4	9,5	5,0				S.	SE.	S.	Clear	Clear	Clear
6	,936	29,966	,956	,944	,900	,946	,942	79,0	89,0	91,2	91,6	87,5	85,2	85,0	4,7	10,9	6,4				S.	S.	S.	do	Haze	do
7	,946	,952	,950	,912	,900	,946	,944	82,2	90,7	91,2	91,8	88,3	86,7	84,3	8,7	10,9	1,5				S.	SE.	SE.	Haze	Clear	Haze
8	,930	——	,936	,920	,888	,920	,912	84,7	——	99,7	95,0	92,4	90,5	86,9	9,0	21,9	15,9				SW.	SW & E.	S.	Clear	Haze	do
9	,876	,890	,896	,858	,852	,874	,874	82,9	98,0	105,3	105,5	92,9	90,0	87,8	10,1	30,0	15,3				SW.	N.	SE.	do	Clear	Clear
10	,856	,860	,858	,844	,842	,846	,846	80,1	98,6	97,0	98,6	91,7	90,6	86,5	7,9	22,4	13,7				S.	E.	SE.	do	Haze	Haze
11	,845	,902	,900	,868	,866	,884	,898	80,3	94,1	102,6	97,1	91,3	90,9	87,3	8,6	24,8	11,7			3,611	W.	N.	SE.	Haze	do	Th. Haze
12	,910	,930	,944	,930	,924	,950	,988	84,1	97,8	94,0	93,2	89,6	89,2	88,8	7,3	19,0	10,6				S.	NE.	E.	do	Clear	do
13	,972	,980	,966	,926	,904	,934	——	82,2	89,9	89,6	90,0	87,7	87,5	——	6,2	8,8	7,4				S.	SE.	SE.	do	Th. Haze	do
14	,926	,932	,920	,910	,890	,898	——	83,0	91,0	98,9	91,4	88,2	87,8	——	9,9	24,9	8,2				S.	W.	S.	Th. Haze	do	do
15	,887	,916	,896	,872	,860	,880	,950	84,0	92,0	95,9	90,2	88,0	87,2	85,0	12,5	20,4	8,7				SW.	WS.	SE.	Haze	H. Clear	Clear
16	,890	,902	,896	,872	,874	,912	,926	80,8	90,2	91,5	90,9	87,1	85,0	85,1	9,1	12,3	6,3				S.	S.	SE.S	H.	do	do
17	,924	,952	,936	,904	,904	,964	,970	82,1	90,0	90,4	91,6	87,3	86,2	86,0	6,3	10,4	6,9				SW.	SE.	SW.	Clear	do	do
18	,958	,972	,960	,942	,873	,902	,908	77,4	91,0	93,0	93,0	87,6	86,7	87,6	7,3	15,5	7,0			3,980	S.SW.	SW.S.	S.	do	do	do
19	,934	,962	,952	,920	,876	,886	,890	80,8	92,2	93,8	92,8	87,8	87,0	86,4	11,9	18,4	7,0				SW.	SE.	S.	do	do	do
20	,880	,912	,918	,882	,868	,898	,906	77,7	92,6	94,6	94,6	90,0	87,9	87,9	7,4	19,2	9,5				SW.	W.	S.	do	do	F. C.
21	,918	,936	,932	,906	,870	,896	,900	80,0	91,7	95,0	95,2	87,1	85,2	85,0	9,5	20,4	4,7				SW.	W.	S.	F. C.	do	Clear
22	,930	,982	,960	,934	,908	,920	,938	85,0	92,0	93,2	92,3	89,3	87,0	86,1	6,2	30,4	7,9				SW.	SE.	S.	Clear	do	do
23	,952	,992	,978	,942	,910	,932	,938	79,2	91,9	94,2	91,4	86,9	86,9	85,8	7,6	19,6	6,0				SW.	NW.	S.	do	do	do
24	,938	,946	,938	,920	,896	,912	,902	77,5	92,6	94,4	90,1	87,5	86,9	86,7	10,7	20,6	7,3				SW.	W.	S.	Haze	do	do
25	,900	,920	,916	,896	,876	,876	,906	78,5	91,2	92,0	91,8	87,4	87,3	87,0	7,3	30,3	6,9			4,042	SW.	SE.	S.	F. C.	do	F. C.
26	,916	,936	,920	,904	,898	,920	,934	77,7	91,3	93,3	91,5	89,4	88,4	82,2	10,5	17,3	9,1				SW.	SW.	SE.	Clear	Haze	Haze
27	,938	,944	,954	,922	,924	,940	,924	79,9	90,6	92,0	91,8	89,1	87,2	87,5	10,0	16,1	10,1				W.	SW.	SE.	F. C.	Th. Haze	Haze
28	,920	——	,932	,914	,920	,906	,870	79,3	——	90,9	91,9	87,9	88,0	86,4	8,0	11,8	7,0				S.	SE.	S.	Haze	Clear	Clear
29	,912	——	,908	,852	,856	,864	——	78,4	——	91,3	91,1	89,1	88,6	——	6,8	12,0	10,0				SE.	SE.	SW.	do	do	F. C.
30	,880	,924	,912	,900	,850	,906	——	77,8	89,3	92,0	93,5	88,2	88,8	——	6,6	16,1	8,9				SW.	W.	SW.	do	do	Cloudy
31	,904	,918	,904	,880	,858	,866	,870	80,4	90,1	92,8	91,9	90,0	89,2	87,8	8,5	16,4	9,4				SW.	NW.E.	SE.S	Cloudy	Haze	Cloudy
Mean	29,923	29,946	29,940	29,912	29,893	29,914	29,922	79,9	90,7	93,2	92,3	88,2	87,0	86,0	7,8	17,1	8,3									

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF JUNE 1836.

	Standard Barometer No. 3 by Gilbert.							Standard Thermometer by Troughton.							Depth of wet bulb Therm.			Rain.			Wind.			Remarks.		
	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	Noon.	Sun set.	Sun rise.	Sun set.	Evaporation.	Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	o	o	o	o	o	o	o	o	o	o	In.	In.	In.						
June 1	29,862	29,882	29,894	29,844	29,842	29,860	—	78,9	90,0	93,0	93,9	87,8	86,9	—	7,3	15,0	11,9			3,889	sw.	s.	sw.	Haze	Clear	Cloudy
2	,870	,872	—	,857	,832	,842	—	74,6	88,9	—	89,9	88,6	87,2	—	8,3	—	10,8				sw.	—	s.	do	do	Haze
3	,860	,888	,892	,860	,848	,894	—	76,4	88,1	91,0	90,0	86,2	86,0	—	7,4	11,9	6,0				sw.	s.	s.	do	Haze	do
4	,888	,920	—	,906	,874	,920	29,924	76,9	89,1	—	88,8	86,5	86,0	84,2	5,1	—	8,5				sw.	—	s.	Clear	—	Clear
5	,902	,935	,908	,860	,846	,850	,862	75,8	88,8	91,7	94,3	88,0	86,1	84,9	6,8	17,0	8,0				sw.	s.	sw.	do	Clear	do
6	,874	,900	,872	,858	,826	,848	,848	78,2	90,2	95,0	93,8	8,80	86,9	85,1	12,1	20,0	10,0				w.	w.	s.sw.	do	do	do
7	,846	,852	,855	,849	,814	,838	,844	80,1	91,9	93,0	91,8	89,0	87,0	86,9	9,2	14,3	10,0				sw.	w.	sw.	F. C.	do	do
8	,866	,916	,902	,896	,882	,874	,872	72,7	90,0	93,6	91,2	88,8	86,6	85,4	6,2	16,9	7,1		0,121	3,722	w.	sw.	se.	Cloudy	do	do
9	,898	,914	,900	,880	,850	,854	,864	77,7	91,0	90,8	90,0	88,1	85,9	85,4	7,9	11,8	7,8				sw.	se.	s.	Clear	do	do
10	,886	,902	,896	,890	,852	,864	,914	75,9	89,3	89,6	89,8	88,1	84,6	84,0	7,5	9,2	—				sw.	se.	s.	do	do	do
11	,908	,968	,952	,938	,920	,931	,958	77,1	87,8	88,8	88,7	86,7	84,8	84,0	5,1	10,8	7,1				sw.	se.	se.	do	do	do
12	,980	,990	,974	,940	,934	,920	,962	78,0	87,4	89,0	89,0	86,2	83,8	83,5	5,3	10,8	6,3				sw.	se.	s.	do	do	do
13	,953	,958	,950	,950	,872	,870	,874	75,5	88,1	88,7	89,3	84,9	84,0	83,5	4,9	9,7	5,7				sw.	se.	s.	do	do	do
14	,872	,900	,888	,863	,842	,856	,874	75,0	91,0	92,4	90,4	87,1	86,0	85,8	5,0	15,1	8,8				w.	w.	s.	do	Cloudy	do
15	,868	,904	,896	,876	,820	,826	,872	76,8	89,3	92,1	95,4	89,6	87,7	87,6	8,4	15,4	6,0			3,507	sw.w.	w.	se.	do	Clear	do
16	,882	,908	,900	,862	,832	,858	,880	76,7	90,3	94,9	92,0	89,0	87,1	86,8	10,0	20,6	11,2				w.	w.	se.	do	Haze	do
17	,876	,912	,914	,878	,850	,854	,870	75,9	92,2	95,0	93,0	89,8	87,3	87,0	7,2	19,7	11,0				sw.	w.	se.	do	do	do
18	,862	,896	,872	,850	,814	,832	,850	76,1	91,5	92,7	92,0	88,8	87,1	87,0	6,2	13,7	9,1				se.	e.	se.s.	do	do	Haze
19	,860	,872	,862	,850	,824	,826	—	83,8	89,8	92,5	94,3	89,2	87,7	—	8,8	15,3	10,8				sw.	w.	se.	Haze	Th. Haze	Cloudy
20	,856	,868	,856	,838	,814	,832	,836	76,9	88,2	91,9	91,6	87,7	84,8	—	8,5	16,0	7,9				w.	w.	se.	do	do	Haze
21	,850	,907	,884	,854	,815	,828	,850	82,5	89,7	93,7	95,8	84,7	84,2	85,0	11,0	18,5	6,5				w.	w.	s.se.	Cloudy	Haze	Cloudy
22	,846	,884	,872	,822	,813	,837	—	80,7	90,5	94,7	96,7	92,0	90,1	—	11,3	20,3	15,0			3,368	sw.	ws.	nw.by n.	do	Cloudy	do
23	,855	,850	,850	,828	,820	,853	—	80,8	88,9	90,5	91,8	80,1	82,0	—	12,3	17,1	14,9		0,215	0,020	sw.	w.	n.	do	do	do
24	,856	,870	,850	,810	,794	,822	—	73,6	81,3	85,7	84,4	83,3	81,1	—	6,0	10,7	7,4	0,139			w.	w.	sw.	do	do	do
25	,828	,844	,840	,820	,802	,808	—	76,0	87,0	91,4	93,2	90,8	88,2	—	7,9	16,4	16,9				sw.	w.	w.	do	do	do
26	,812	,824	,794	,786	,786	,782	,788	79,0	87,0	87,1	90,1	90,3	89,0	88,6	13,4	13,6	18,0				w.	w.by s.	w.	do	do	do
27	,790	,800	,802	,786	,768	,770	—	76,2	88,3	91,1	93,2	92,3	90,9	—	12,5	18,6	19,3				s.by e.	w.	s.	Haze	do	do
28	,804	,842	,824	,802	,782	,804	,850	77,0	90,6	92,2	94,0	93,8	91,6	90,9	10,7	17,2	18,9				s.	sw.	w.	do	F. C.	F. C
29	,874	,912	,894	,858	,838	,850	—	79,5	90,9	94,0	94,6	89,0	85,9	—	11,9	19,0	9,7			3,578	w.by s.	nw.	sw.	Clear	F. C.	Haze
30	,882	,924	,888	,854	,838	,858	,864	78,8	90,9	95,0	92,5	79,0	85,9	84,4	11,3	19,7	10,7				sw.	w.	se.	do	Th. Haze	do
Mean	29,869	29,894	29,881	29,857	29,823	29,849	29,873	77,4	89,3	91,7	90,8	87,7	86,7	85,8	8,5	15,5	10,4									

Madras Jour. Lit. & Science.
MAP
of the
NEELGHERRIES
Goodaloor
Segoor Pass
Moyar River
Guzzlehully.
To Salem.
Neddiwuttum
Pykarra
Billicul
Orange Valley
Kallia
Kotagherry
Ootacamund
Nunjanaud
Coonoor
Makoortee Peak
Pioneers Camp
Mateopollium
Sooondapettah
Bowany River
Mailur
Nellitory
Granite
Pegmatite
Hæmatitic
Iron Ore
Hornblende Slate
Basalt
Sienitic Granite
Lithomargic Earth
Umber A
Colophenitic Rock B
Cinnamon Stone C
Magnetic Iron Ore D
Titaniferous Iron Ore E
P. M. Benza, M.D. pinx
Scale of 4 Miles to an Inch
Miles



MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

No. 13.—*October,* 1836.

I.—*Memoir on the Geology of the Neelgherry and Koondah Mountains. By* P. M. Benza, Esq. M. D. *of the Madras Medical Establishment.*

"In a rapidly advancing science like Geology, to which new facts are constantly added, and in which the chances of new views by their combination are consequently multiplied, it is almost impossible to avoid hazarding certain general *conclusions,* when the various known facts pass in review before us."*

The group of hills, called the Neelgherries, may be considered as the southern termination of the western Ghauts, which at this place end in abrupt, lofty, and almost vertical precipices; the extensive valley of Coimbatore, dividing them from the Paulghaut chain, which, in the same direction as the Ghauts, extends down to Cape Comorin.

The Neelgherries form an elevated plateau, projecting in an easterly direction, from the line of the ghauts, in the form of a triangle, the base of which is the continuation of the ghauts themselves.

They rise abruptly from the table-land of Mysore, in stupendous cliffs, with an elevation of many thousand feet. Two rivers encircle them, as it were, running round their base. The Bowany river, rising in the western side of the Koondah, and among all the hills of that group, runs in an easterly direction along the foot of the outside of the Neelgherries, and, just below the apex of the triangle, is joined by the Moyar, which together with the Pykarra, having their origin in the Neddiwattum range precisely opposite the sources of the Bowany, and making a sharp curve after leaving the hills, runs an easterly course,

* De la Beche's Geological Manual, Preface, page v.

joining the Bowany at Danikancottah, and under that name, after running about thirty miles, they discharge their water into the Cauvery.

The Neelgherries*, being the highest hills in the whole of the peninsula, south of the Himálaya, possess a greater degree of geological interest than any other group in this extensive region.

Their being almost in the middle of a district, in which one of the most interesting rocks in the Indian formations (the laterite) is found developed in all its characteristic features, adds not a little to their importance in a geological point of view. On account of their superior elevation, they ought to be carefully examined by the geologist, before he extends his researches to the other parts of the chain, of which they form the most elevated point.

It was, undoubtedly, after consideration of this kind, that the late Doctor Turnbull Christie, of the Madras Medical Establishment, had begun his geological survey of the peninsula from the Neelgherries, as from a point where the rocks, found at a lower level, are seen in their original state, unmodified, and unaltered by formations and deposits, which events and revolutions, subsequent to the elevation of the whole chain of the western ghauts, must have produced; and had his life been spared, he would, undoubtedly, have given to the public the most accurate and comprehensive account of the geological formations of this interesting part of India, and would have settled many doubtful points in Indian geology, which now keep many of the ablest geologists in a state of uncertainty and suspense.

The few memoirs he published regarding the geology, not only of India, but of those places through which he journeyed, particularly of Sicily, show what was to be expected from a man, who evinced so much information and accuracy of observation on those subjects. Unfortunately for Indian geology, he was cut off at the very beginning of his labours on these very hills, which had in preference attracted his attention and researches.

We are told that the experienced eye of the geologist can easily guess the nature of the rock composing a hill or a system of hills, by the simple inspection of its outlines: thus, spiry peaks show the formation to be primitive; rounded smooth outlines are indicative of calcarious mountains; while the castellated ruin-like appearance of a mountain, is proper to the sandstone formation.

This criterion, however, would lead into error regarding the nature

* "The Neelgherry Hills are situated between the parallels of 11° 10' and 11° 32' N. latitude, and 76° 59' and 77° 31' E. longitude from Greenwich; their greatest extent in an oblique direction, from S. W. to N. E. is from 38 to 40 miles, and their extreme breadth 15; taking in account the great undulations of the surface, and the breadth above stated being pretty constant throughout, their superficial extent may be fairly estimated at from 6 to 700 square geographical miles."—*Baikie's Observations on the Neelgherries.*

of the rocks forming the Neelgherries. Although their contour is even, smooth, rounded, and, as it were, undulating, the fundamental rocks of which they are composed belong to the primitive class.

Their outline resembles those hills and eminences we meet in districts, resulting from tertiary or alluvial deposits. What the rock is, which gives those hills the rounded form they exhibit, will be shewn hereafter.

With the exception of some vertical cliffs and mural precipices, seen in the boundaries of this elevated plateau, and a few projecting masses of the fundamental rocks on the summits and declivities of these hills, the whole group is uniformly covered by a thick stratum of vegetable earth (No. 1*), which overlaying a thicker stratum of red earth, (to be described in the sequel), supports numerous plants, chiefly grasses, which, growing most luxuriantly in thick contiguous tufts, give the surface a smooth carpet-like appearance. This vegetable earth in general is clayey, and of a grey colour, and very friable. On this soil we occasionally see small rounded pieces of the decomposed subjacent rock, bestrewed particularly on those spots where blocks of the decomposing rock are seen jutting through the soil.

This vegetable soil is replaced in the low valleys and flats at the foot of the hills, by a black soil, such as we frequently see forming the peat-bog in swampy grounds, in which a large quantity of vegetable matter is decomposing (No. 2).

This soil is of a black, or deep brown, colour; of tenacious consistence, when moist; crumbling into powder, and often splitting into prismatic masses, when dry. At first sight, it resembles the black soil of the plains of India. From this last, however, it seems to differ greatly, in containing a large quantity of carbonaceous matter, and much oxide of iron.

To deprive this black soil of the greater portion of its humidity, I exposed it to a heat, sufficient to melt lead, and after having weighed a certain quantity of it, subjected it to an intense heat for an hour; after this, it had lost more than 25 per cent. of the original weight, and had changed into an ochrey red powder (No. 3), without undergoing any vitrification, as is the case with the black soil of the Deccan, (Voysey). It would therefore appear, that the loss is owing to the oxidification and consequent volatilization of the carbonaceous matter.

This soil, although more frequently found in low situations, is often seen in a thick stratum on the declivities of the hills, such as on the slope of one of the Doodabetta group, facing the cantonment; on that of the Elk Hills, (S.) above South Downs; near the Kaitee Pass, and in

* The figures refer to illustrative specimens presented for deposit in the Mineralogical Cabinet of the Madras Literary Society.—*Editor.*

many other localities, where I have remarked about it a most luxuriant vegetation of innumerable ferns, of which the roots are seen decaying into a black powder.

In many places below this black soil, and sometimes under the vegetable earth, we see thick beds of a yellow ochreous earth abounding with silica (No. 4). Indeed, in some places, as at Kotagherry, it resembles very much the yellow Venetian Tripoli, previous to undergoing preparation for the arts (No. 5). The geological position, however, of the two, differs very much—the Venetian Tripoli, which is brought there from Corfu, and from the neighbouring coasts of Epirus, is found (as I have had opportunities of ascertaining) in the sandstone formation, which alternates with the magnesian limestone*. The kind of Tripoli I met with on the Neelgherries, seems to be the result of the disintegration of a species of iron flint found in primitive formations; some of the specimens I collected, have a great resemblance to the Eeisenkeissel of Werner (No. 5½). Some varieties of the finest white Tripoli arise from the decomposition of silicious rocks, such as calcedony, in Corfu and in upper Italy; but in general, the Neelgherry specimen is not so silicious, and seems to contain a good deal of alumina and iron. It is in this yellow clay that we occasionally see some tubular bodies, formed by concentric layers of the same clay, round the numerous roots of plants that grow on the soil above (No. 6). But what attracted my attention most was, to see (at Kotagherry) those tubular bodies traversing the thick stratum of black earth, which overlays the yellow clay, without having a particle of it in their composition. As if the roots, by a kind of capillary attraction, sucked up through the black soil, without mixing with it, the particles of the yellow clay which, undisturbed by the vicinity of the black soil, arranged themselves concentrically to the root; and the latter decaying has left the cavity of the tube empty†.

* It seems to be an argillaceous iron ore, similar probably to the one at Ashburnham, used for the manufacture of Tripoli, and belonging to the Hastings sands.—See Fitton's *Geological Sketch of the vicinity of Hastings, page* 50.

† "Brongniart alludes to something similar to these tubular bodies, enclosing the roots of plants in sandy places, where the iron appears to aggregate the sand round the roots; and he concludes the paragraph by confessing his inability to assign the cause producing it 'et dans ces-çi la cause qui a accumulé l'oxide de fer à l'entour de la racine ....est encore difficile à assigner.—*Tabl. des Terr. qui composent l'Ecorce du Globe, page* 56.

My friend Mr. Malcolmson, late Secretary of the Madras Medical Board, writes to me as follows: On the banks of many of the streams in the Deccan, the black soil is seen penetrated by tubular *incrustations*, resembling *kankar;* they are evidently formed round the roots of plants, the decay of which leaves a cavity which may sometimes be seen to divide and ramify. Some of those in the banks of the Kanar river, Kamptee, near Nagpore, are more than an inch in diameter.

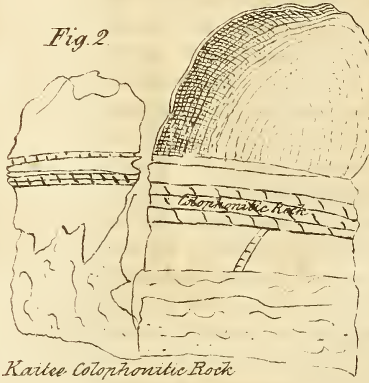
Mr. Prinsep states that "Sergeant Dean's Jumna collection exhibits many incrustations of calcarious and ochreous matter of a similar nature."—See Journal of the Asiatic Society of Bengal, vol. 4, p. 506.

BRITISH MUSEUM
NATURAL HISTORY.

Fig. 1.

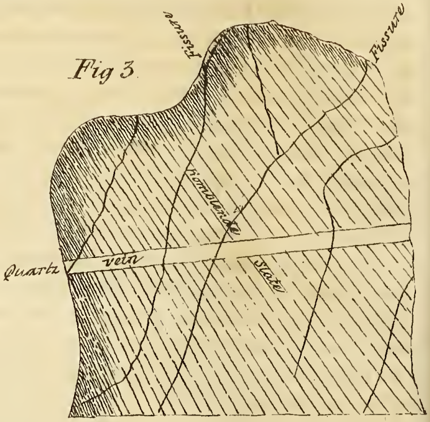
Section of the Road-cut near the Lake

Fig. 2



Kaitee Colophonitic Rock

Fig 3.



Basaltic Dyke through Granite near Sispara Western Koonda Ghaut.

Fig. 4.

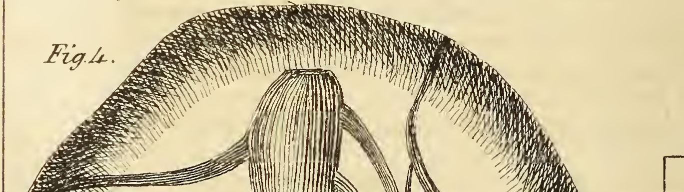


Fig. 6.

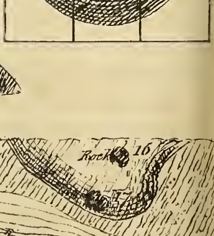


Fig. 5

Makoortee Cavities

Immediately below the vegetable soil, in almost all places, we find a stratum of detritus (in general not above a few inches thick), which is different in different localities, according to the nature of the rock on which it rests. Thus, it is ferruginous on those places where iron ores are found : quartzy and silicious above the thick veins of quartz, which intersect these rocks. But in general it is composed of small fragments, sometimes rounded, and sometimes angular, of the decomposed rock (of which we shall speak hereafter), being identical with that we see on the surface of the soil (No. 7).

The simple inspection of this detritus, overlaying, and corresponding in position and nature with the subjacent rock, forces upon us the conclusion, that it does not belong to the alluvium (terrains de transport), but that it has its origin in the disintegration of the rock *in situ*, without any, or any material, displacement from the rock which has given rise to it.

Another fact that proves this detritus to arise from the decomposition of the underlaying rock, previous to its becoming lithomargic earth, and while in the dry friable state which seems to have preceded it, is, that the porcelain earth, wherever this last earth is found in large beds below the vegetable earth, is never overlaid with detritus ; because the rock is all at once converted into porcelain earth, without the intermediate passage into the dry friable rock, from which the detritus arises.

This detritus is seen almost in all localities on these hills ; the numerous sections that have been made in their declivities, for the new roads, show it clearly everywhere. On looking at the banks on the sides of those sections, we observe the detritus adapting itself to all the irregularities and zig-zags of the subjacent rock, or stratum. Fig. 1 of Pl. VII. shows this conformity better than any description. It is taken from the bank of the road round the lake near the bund.

That this detritus has not been transported from any distance is further proved, by observing it on the surface of the soil in those places where the protruding rocks are either decomposed or decomposing. We often see the still undecomposed nucleus of the rock protruding through the soil, surrounded and enveloped by the numerous concentric layers of the decomposed rock, the bassets of which we see level with the soil, the upper portion of them having been disintegrated into a detritus, which is scattered on the soil in the vicinity of the blocks. As far as I know, no organic remains have hitherto been found either in this detritus, or in the black soil.

In some places the detritus, for causes difficult to guess, assumes a degree of hardness, and approaches a conglomerate ; the small rounded pieces being agglutinated by a clayey paste, resembling a pudding-

stone. This is particularly the case in those localities where it overlays the iron ores, so abundant on these hills. When the subjacent rock is the hæmatitic iron ore, the conglomerate resembles exactly the pisiform, or oolitic iron ore, and in some places it is hard enough to be used for architectural purposes. The conglomerate in this state of aggregation is similar to some varieties of laterite found in the plains of the Carnatic. But this pisiform iron ore is not to be confounded with another rock, which also resembles laterite, and is met with on these hills in enormously thick beds, hereafter to be described.

Below the detritus, in almost all places on the hills, we find a thick stratum of an ochreous red earth, which occasionally assumes both the appearance and the composition of lithomarge, and for this reason, I shall call it hereafter indiscriminately either lithomargic, or red earth. In some of the lower hills, this stratum is above 40 feet thick, as it is near the bund of the lake. It is this red earth, which, filling up the interstices among the original inequalities of the projecting rocks, has given the hills their rounded appearance, by smoothing all the asperities and irregularities of the original rock ; or, to speak more correctly, the projecting points themselves have been smoothed down, by their own decomposition, into lithomargic earth.

In general, this red earth is of a mottled colour, or streaked with different hues of red, yellow, crimson, white, and grey or brown. It feels unctuous to the touch, and crumbles into dust when pressed between the fingers. It does not form a paste with water, but subsides to the bottom of the vessel. The different colours of this earth are separate and distinct, having a decided line of demarcation, so as to show that they are produced by the decomposition of separate and distinct minerals. We occasionally find in it thick veins of pure white felspar decomposed into porcelain earth, traversing it in all directions ; precisely as we observe the same veins of felspar, in an undecomposed state, traversing the hard rock, which forms the hills.

This red lithomargic mould is evidently the result of the decomposition of two of the rocks, which almost exclusively form the Neelgherries ; viz. the sienitic granite, and the hornblende rock, or primitive greenstone ; of both which we shall speak hereafter.

It seems that before the rock is transformed into red earth, it passes into a dry friable substance, which sometimes has consistence enough to be cut and used for architectural purposes ; many of the stones used in the construction of the Koonoor bridge, are of this nature. The second stage of the decomposition is that, in which it becomes of a soft consistence and earthy texture : the minerals composing the rock still retaining their relative position as before. Thus we see in the lithomargic earth, what was hornblende, changed into a red ochrey substance ; the felspar into a white clay ; the numerous

garnets into a crimson-coloured clay; the quartz alone remaining unaltered and undisintegrated, which, after all, occurs but in a very scanty proportion in the rock (No. 8).

It is curious to observe, that the substance of the crystalline rock is not protected from decomposition by the thick layers of its own decomposed substance; and, notwithstanding its being buried many feet beneath the surface of the soil, under a thick stratum of vegetable earth, detritus and lithomargic earth, the decomposition appears to be going on without the concurrence of the atmospheric air.

In many places the entire block has undergone the process of decomposition, and in the sections for the roads, we occasionally see many concentric layers of the decomposed rock, like the coats of an onion when cut transversely. It is not rare to observe, that these coats have, in many localities, a kind of crust *(enduit)* of a black substance, probably oxide of iron (No. 9). The decomposition of the rocks takes place from outside inwardly, and appears to proceed, or to have proceeded gradually. It seems that the felspar and the hornblende are the first to be decomposed, the one (losing the alkaline matter? Sir H. Davy) becomes opaque and whitish; the other, by the hyperoxidation of its iron, is converted into an ochreous clayey substance: the garnets do not resist decomposition long; but the only change that the quartz seems to undergo is in its degree of compactness; become friable, and easily reduced into sand by the fingers.

An additional, although negative, proof regarding the transformation of the granitic rock into lithomargic earth, is, that on those hills where no rocks containing hornblende are found, this earth is wanting. This is the case on the summits of Doodabetta, Elk Hill, Kaitee pass, &c., in which places the protruding rock being either granite, or pegmatite, it exfoliates in laminæ like granite, instead of decomposing into red lithomargic earth.

It would be worth ascertaining, whether the crimson-coloured dots and streaks in the lithomargic earth be owing to the decomposition of the numerous garnets contained in the original rock. I have had opportunities, more than once, to remark, that in those localities where the sienitic granite abounds with garnets, the lithomargic earth, resulting from its decomposition, has the crimson coloured dots similar to those in the undecomposed rock (No. 10). I have made the same observation in the decomposed gneiss in the Northern Circars, where it abounds with this mineral.

A question naturally presents itself after the above remarks, regarding the decomposition of the granite, and hornblende rock of the Neelgherries. The same identical rocks are found in many parts of the Peninsula, particularly along the chain of the eastern ghauts; and yet their decomposition does not give rise to the same results. As I have

visited but very few localities in India where these rocks prevail, I cannot positively say whether or not the result of their decomposition in both localities be the same*. But, this is certain, that the causes, which may have contributed to decomposition in one place, do not exist in the other: of that class are cold, damp, frost, elevation, &c., which are not found in the low lands. Besides, is this decomposition the effect of *existing causes*, or the consequence of *time* and *revolutions* gone by?

Here I must remark, that in some localities, such as near the bund of the lake, on the road below the church, above the bazar, &c. the red earth assumes the composition, texture, and appearance of real lithomarge.

As I have proposed to abstain from speculations, and from farfetched theories, I shall not enter into any hypothesis respecting the causes of this decomposition. It is enough to have noted a geological fact, which requires but simple inspection to be certain of its existence. I shall therefore proceed to describe some minerals, which are found imbedded in the red earth; some of which might prove very useful and advantageous in the arts. Such is the porcelain earth, found in enormous beds, and of the greatest purity, in this locality.

This mineral is evidently derived (as it is almost in all places where it is found in Europe) from the decomposition of the pegmatite or graphic granite, which is chiefly met with in primitive districts. As this rock does not appear to be common on the Neelgherries, I found it difficult, at first, to account for the origin of the numerous and thick beds of porcelain clay. It was after visiting and examining the summits of some of the highest hills, that I found a variety of pegmatite forming many of the most prominent rocks on them. Such are the summits of Doodabetta, Elk Hill, Kaitee pass, some of the peaks of the Koondah, and probably many other places which I did not visit.

It is undoubtedly to some of the erratic blocks and rolled masses of this rock; or to the decomposition of those beds of pegmatite, into which the true granite of the high hills seems to pass, that the porcelain earth is owing. Of these blocks, still in an undecomposed state, we see many in the valley of Kaitee derived, in all probability, from the summit of Doodabetta, or from that of the rock of Kaitee where the pegmatite is seen *in situ*.

By comparing a piece of this porcelain earth, just taken out of the bed, with a piece of the hard pegmatite rock, one cannot but be convinced of their being the same rock; the one in a hard, the other, in a decomposed state (No. 11). The pieces of the crystalline smoky

* Doctor Heyne says, "a red soil prevails where sienite forms the apparent ground rock."—*Tracts Historical and Statistical on India, page* 349.

quartz (which is the only other mineral entering in the composition of the pegmatite, besides felspar) are still visible in the same situation, as when the rock had not undergone decomposition, having become more brittle, and easy of disintegration.

The porcelain earth is not to be confounded with that which results from the decomposition of the pure felspar veins, so frequently seen in the sienitic granite. By simply looking at both specimens, the difference is discovered (No. 12). The latter has no sandy particles in its composition, such as are found in the other, which by such addition is better adapted for the manufacture of pottery, in which silicious sand is a necessary ingredient.

I speak with some hesitation regarding a mineral I found only in one place on the Neelgherries, and I am doubtful whether it exists in any quantity in those hills. It is a brown ferruginous clay, very closely resembling umber, particularly that kind which is exported from the Island of Cyprus (No. 13). I found it between two large blocks of decomposing sienitic granite, or rather hornblende rock, with garnets, close to the bund of the lake.

The next rocks to be described are two metallic ores, in all probability, originally imbedded, as veins, in the rock: which last being now decomposed, they are left imbedded in the lithomargic earth: indeed, one of these ores is still seen as a vein, in the undecomposed rock.

The first is the magnetic iron ore, so common in many parts of India, and which, besides the metal, contains variable proportions of quartz (No. 14). The places where I have met with this iron ore are marked in the map: in some of them the ore is imbedded in the lithomargic earth, while in others it is like a vein in the rock. I saw it in this last position in the road descending to Kaitee valley, where the metal is very little in quantity, compared with the granular quartz, which in some parts of the vein predominates to the almost entire exclusion of the metal (No. 15).

The two places on the Neelgherries, where I have seen this ore very rich in metal, are, one near the village of Vartsigiri (Kotagherry), and the other close to, and traversing, the Lake of Ootacamund in two places. The specimen from Vartsigiri (No 16) is very compact and rich in metal. I took it from a large block, probably the outgoings of a thick bed at the southern extremity of the valley, at the other end of which the village stands.

Generally speaking, the quartz is lamellar, very rarely granular, and it seems to alternate with the metal in parallel laminæ. The appearance, composition, and proportion of the ingredients of this magnetic iron ore are very different in different places; nay, in the same vein. For instance, the vein seen just below the building called

Gradation Hall, between the road and the margin of the lake, in its N. E. extremity, has a compact, metallic structure, highly magnetic, with hardly any quartz (No. 17) : a few yards to the southwest, the vein contains a good deal of quartz ; the metal is more oxidated, although maintaining still its magnetic powers (No. 18). Following the vein in the same direction, we see it appear in the opposite side of the lake, in the banks of the road, which goes round and close to the lake. There the ore has lost a good deal of its quartz ; the iron is more oxidated, and the rock assumes a kind of columnar structure (No. 19). This is the appearance of the vein in the section for the road. But the out-croppings of the vein at top of the same hillock are compact, scabrous, and of a slight cellular texture (No. 20). Going on always S. W., we see the same vein continued over the next hill, close to the road going to the Koondah ; and so much divested of iron, that it resembles a friable stratified sandstone, the quartz being granular (No. 21).

It is in this kind of magnetic iron ore, particularly in the blocks below Gradation Hall, that I remarked on the quartz laminæ, small brilliant, gold-coloured specks, precisely similar to those seen in the auriferous quartz veins in the rocks of the Malabar coasts, specimens of which have been deposited by my friend Colonel Cullen in the museum of the Asiatic Society of Bengal. Does this appearance indicate the existence of particles of gold in this ore ? We know that in America, gold is occasionally found in the siderocriste, which is a species of quartz iron ore, like the one just described*.

It is the belief of some people, that owing to the similarity of the rocks, of the detritus, and of the quartz veins, of the Malabar coast, and of these hills, gold may be found in this last, as well as in the former. The specimen of the earth I send is taken (No. 22) from an excavation made, some years ago, by an officer, who had been employed on the Malabar coast, for the purpose of ascertaining the existence of gold in the detritus of that coast. It is said that he found gold in the earth dug upon the side of one of the hills of the Doodabetta group, facing the cantonment†.

Before concluding my observations regarding this magnetic iron ore,

* The specimen of Colonel Cullen is marked "auriferous quartz, stratified : Nelli Allum, Malabar." The same gentleman sent to the museum another specimen, which he calls "auriferous mica-schist," which contains the same kind of shining, gold coloured specks.

† The sand which results from the disintegration of this species of iron ore is very nearly similar to what is called titaniferous sand.—Does any menaccanite exist in this sand ? The rock in which this ore is contained, appears to be similar to that which is seen in Cornwall, from which the sand containing that new mineral is derived. Professor Sedgwick informs Mr. De la Beche, that the menaccanite of Cornwall is derived from the *decomposition* of *a hornblende rock*, composed of hornblende and felspar.—*Geological Manual.*

I must repeat what I said in the beginning; that it is found in thick beds, evidently imbedded either in the original rock, or, which comes to the same thing, in the lithomargic earth, the result of its decomposition.

Iron ores are so common on these hills, independently of the oxides of that metal contained in the minerals forming the rock, that many springs of water are of the chalybeate class*.

The next species of iron ore on the Neelgherries is the hæmatitic, forming immense beds, and sometimes whole hillocks, among the hornblende rocks, and sienitic granite. In all the places where it is found, large blocks of this ore are seen projecting through the soil, having a scabrous, cellular, and sometimes cavernous appearance at the surface.

As this rock resembles very much the laterite of this part of India, I shall be more particular in describing its geological position and association, in order that it might be seen whether it ought to be classed with the laterite of the low lands, or among the iron ores found in many other parts, associated and in veins, in primitive districts.

Before entering into the description of this rock, I must remark, once for all, that the position and association of the rocks on the Neelgherries is not so easily ascertained, and clearly seen, as in other localities of India, on account of the enormously thick stratum of red earth and vegetable soil, which cover uniformly the whole plateau. So that we are often reduced to the necessity of judging of the nature of the rock composing the hills, by the few projecting masses at the top, or on its declivities.

It is for this reason, that I am unable to say positively whether the rock I am going to describe be overlaying, or one of those metallic veins which traverse the original rock; although I have more than one reason to surmise, that the last is the position of this ferruginous ore on the Neelgherries.

All I have been able to ascertain regarding this ore, may be detailed by describing one or two of the localities, where this formation is seen developed in a more marked manner than anywhere else on the Neelgherries.

The most extensive formation of this hæmatitic iron ore is seen on both sides of what I shall call Scotland Valley†. It is the valley through which the superfluous waters from the lake discharge themselves into the Moyar river; this valley runs nearly E. and W. Above two hundred yards below the bund of the lake; close to the left bank of the stream, we see a large block of compact iron ore jutting through the soil (No. 23). Proceeding westward along the right bank of the

* Baikie's Observations on the Neelgherries, page 14.

† Sir Frederick Adam, Governor of Madras, called it by that name, on account of a resemblance he saw in it to some place in Scotland.

torrent, for about a quarter of a mile, we come to a place where the stream is joined by another flowing from the S. W. On both sides of this river (until we come to this junction), the projecting rocks which in some places make up knolls and hillocks, are of the usual sienitic granite, with a good deal of hornblende and a few garnets.

On fording the river, at the place of junction, we see on the opposite bank all the projecting rocks to have totally changed their character; they are now cellular, hæmatitic iron ore, rich in metal (No. 24). That rock is seen protruding through the soil of this and of the next hill (W). Some of the enclosures for cattle on the declivities of this hill are constructed with large masses of the cellular iron ore, which however in some of them has a very compact structure (No. 25).

The highest of the two hills appears to be entirely formed of this rock, of which huge masses are seen in the intervening ravine. On the summit of the highest hill, the rock assumes a pudding-stone-like structure, being a hard conglomerate of numerous rounded pieces of ferruginous clay iron ore, strongly agglutinated together by a clayey cement (No. 26). A prodigious number of these rounded pebbles are scattered about, covering nearly the whole of the summit of the hill (No. 27). Many of the hard blocks of this conglomerate resemble very much (if they are not identical with) the laterite of the low lands of India.

Descending from the summit, along the western declivity of the hill (facing Pinnapal Hill), and only a few yards from the top, the rock insensibly changes its appearance and structure. It becomes by degrees more compact, and loses its cellular structure; in short, it assumes the compact appearance of common hæmatitic iron ore (No. 28), very rich in iron; and in this state it continues to the foot of the hill on that side, where some of the projecting masses of this iron ore are flanked by others of sienitic granite, or rather hornblende rock.

These two hills, on the N. E. side, and at their foot, close to the stream, are skirted by immense masses of sienitic granite, through which the waters of the river are heard roaring; except at one place, at the foot of the high hill, where the river is forded to go towards the new road from Neddiwatum to Ootacamund. In that place the iron ore bed crosses the stream; forms numerous projecting masses on the slope of the opposite hill, having a N. E. direction; crosses the road of Neddiwatum, and terminates in the summit of the hillock to the N. E. of the road; beyond the latter place, this rock cannot be traced.

Now this filon of iron ore, after crossing the stream of Scotland Valley, is *evidently* and *clearly* seen *flanked* on *both sides* by sienitic granite, jutting in large blocks through the soil, in the very same way

as the masses of the iron ore shoot up; and therefore, it is fair to conclude, that the last do not overlay the former.

I must here call the attention of the reader to the almost imperceptible transition of the cavernous tubular kind of ferruginous conglomerate, into the uniformly compact hæmatitic iron ore of this hill: an appearance that I had an opportunity of observing also in the Northern Circars at Pandagaram, near Samulcottah, where the compact, slaty hæmatitic iron ore is seen passing into a conglomerate very much like laterite (Nos. 29 and 30).

The two hillocks S. E., and close to the lake, and on which Cluny and South Down houses are built, are chiefly composed of the same iron ore. The sections in these declivities, on account of the road which goes round the lake, show the ore decomposed into a red clayey earth, imbedded in the lithomargic earth, resulting, as we have seen, from the decomposition of the original sienitic rock.

Before concluding these details regarding this iron ore, I will point out some particularities, in which (notwithstanding its similarity in appearance) it seems to differ from the laterite of the other parts of India, that I have had an opportunity of examining. The rock of the Neelgherries is by no means so cavernous, and has not so many tubular sinuosities as the laterite of the Carnatic, Northern Circars, &c.; it seems also to be richer in metal, and, what appears to constitute a marked difference, it is entirely divested of any quartz, or sandy particles, which abound so much in the laterite of other places. Besides, we are told by Doctor Heyne, that in the laterite of the Red Hills, Nellore, &c. a marl or carbonate of lime is occasionally one of the ingredients; no traces of this carbonate are found in the stone of the Neelgherries*.

That this rock of the Neelgherries is to be classed with hæmatitic iron ore, rather than with the true Indian laterite (an overlaying rock), is very probable, considering that rocks similar in appearance to it are found in Europe, while the last is peculiar to India†.

It is said of the Indian laterite, that it is associated occasionally with trap. On the Neelgherries, basaltic dykes are not rare, yet I never saw what Voysey remarked in other parts of India, viz. the passage of basalt into wacke, and into iron clay, (by this last name, meaning laterite); another additional difference between the two rocks.

Hitherto no organic remains have been found in this rock on the

* Tracts.

† If my memory serves me right, I think I saw in the museum of the Asiatic Society of Bengal, a specimen marked "black, brown, solid and perforated iron ore, from Poetz in Upper Lusatia," which appears to me similar to the Neilgherrie's hæmatitic, cavernous iron ore.

Neelgherries, which appears also to have been the case with the laterite of the other parts of the peninsula.

As it is by accumulated facts, and accurate information on the structure, associating rocks, &c. that a rock may be properly characterized, I hope that my observations, (such as they are), will contribute to augment the number of facts, respecting the nature, composition, and origin of the laterite; and prove acceptable as an addition to the data, indispensably necessary in enquiries on such subjects; which, when collected in sufficient number, it is only required that an able, patient, laborious and active geologist should arrange, and compare with those *he himself* has attained by *personal* inspection, and examinations of the different localities where the rock is found, to arrive at something like a definitive conclusion regarding this, as yet, obscure subject; because to trust to hand-specimens, in researches and enquiries of this sort, would be equivalent to the *fodere Isthmum.*

As far as my short stay in India, and my limited and confined observations, enable me to speak, on this intricate question, I think that, among well informed people, under the name of laterite two, or rather three, sorts of rocks are included; to say nothing of the common mistake of misapplying the name to the decomposed rocks of the primitive class, or to any other that has a red, ochreous colour, and softish consistence.

The first species, of which I am going to say a few words, I only know by hand specimens in my possession, by having examined those in the Museums of Madras and Calcutta, and by the description of the late Dr. Ward; therefore I can say but very little regarding its geological position, and associating rocks. It appears that it is very common in the eastern Islands and Malacca; it seems to be an unstratified rock, perforated by numerous tortuous, tubular cavities, which are either filled or lined with pale yellow decomposed felspar; the texture of the rock between these perforations is compact, with a dull fracture, and adheres to the tongue. The colour is ochreous, with spots of pale yellow decomposed felspar; it does not appear to contain any other mineral, or extraneous substance, except the felspar, and ferruginous clay—fragments or grains of quartz are never met with in this rock (at least in the specimens I mentioned)—there is not the most distant appearance of a breccioide or conglomerate structure, and its specific gravity is a good deal less than the other two species. In short it is a simple, compact, tubular, or perforated iron stone. I have not Dr. Ward's account of this rock to consult; I therefore cannot say positively, but I think he says that it is invariably in an overlaying position.

The second is one which appears to have been described by many geologists, and I also contributed my little portion of facts, on this

subject, a year ago, when my early observations on the Geology of the Neelgherries appeared in the Bengal Journal. This rock results from a modification of structure, and a change of texture in the hæmatitic iron-ore; which (as well as the magnetic species of the same metal) in India forms enormous beds, whole hills, and ridges; and therefore must be considered as a vein or a bed of this metal, like the titaniferous iron ore, the magnetic species, the chromate, the one with manganese, &c. which all are imbedded, or impacted substances, and not a principal rock, so as to deserve the name of a distinct formation, different from the other members of the same family, because it is cellular; we might as well call burnt clay pumice-stone because of its cellularity. The change of structure of this rock consists, in becoming, from compact, cellular, but hardly ever *tubular*, with a surface rough and bristled with asperities; in a few blocks some of the cavities are lined with a yellowish substance; it hardly ever contains quartz or sand; but often small pieces of compact felspar, in a decomposed state; occasionally it has a breccioide structure.

Whatever might have been, or is, the cause of this change in the appearance of this ore, it is connected with atmospheric vicissitudes. To prove what I have been hitherto describing, regarding this modified iron ore, that it is nothing else than a mere change in appearance, and not a new rock, I have specimens in my possession, and have deposited others in the Museum of the Madras Literary Society, which shew in the small thickness of an inch, or little more, the ore changing from compact hæmatite into lateritic iron ore.

This iron ore disintegrates, the pieces getting rounded, for reasons not easily explained, and are either scattered about the soil, or re-aglutinated by a clayey paste forming a conglomerate; which either adheres to the lateritic rock or to the ore itself. If these rounded pebbles are of moderate dimensions, and of different sizes, a conglomerate is the result perfectly similar to the conglomerate laterite of the Carnatic; but, when the pebbles have an uniform size, and are not larger than a pea, then it becomes the common pisiform iron ore, the pisiform clay-ironstone of authors. In this state, the rock has different degrees of compactness from crumbly to compact; in which last case it is employed for architectural purposes. This detrital rock sometimes is seen at some distance from the iron ore.

The third species, which abounds all along the intervening land, from the foot of the western ghauts to near the sea shore, resembles very much the modified hæmatitic iron ore (not the pisiform) being cavernous, not tubular, abounding with quartz pieces and sand; having not only the cavities lined with powdery felspar, but, in the compact portion of the rock, having small pieces of the same mineral in the compact state. The late Dr. Christie tells us that it is remarkable, that this rock

occupies both the foot of the hills, and many of their summits likewise; so hinting at the possibility that the ghauts were elevated after the formation of the laterite.*

With regard to the question, whether all these three species of stones, which resemble each other, had the same origin, or the conglomerate kind arose from the disintegration of the unstratified simple species, which we described at the first, I leave to some more fortunate geologist to describe, who may have opportunities of visiting, and attentively examining, the localities, where the laterite is found, to decide the momentous question.

The only information I can contribute I have already given in the foregoing paragraphs; that is, that in more than one locality, both on the low lands and the hills of India, I have found a modified iron ore, perfectly similar to the laterite, and that, to avoid confusion or doubt, I have called it lateritic iron ore. It is not a rock *per se*, but the result of a modification in the structure of the metallic ore, which forms not only enormously thick beds and filons, but also whole hills, among the formations of this part of the globe; which modified iron ore, either as such, or in the state of conglomerate, resembles the laterite of Malabar, and of the Carnatic.

I am not positive regarding the existence of manganese on these hills: my friend Colonel Cullen says, that it is found mixed in the iron ore near the lake; and I found a straggling piece of this ore in the valley of Kaitee (No. 31†), which I have not analysed, but which has the external characters of one.

The lowest visible rock of the Neelgherries is of the primitive unstratified class, including true granite, pegmatite, sienitic granite, and hornblende rock: sienitic gneiss, and hornblende slate are occasionally seen, but they belong more to the outskirts of the hills than to the group itself. Besides these rocks, we find granitelle, and a rock composed of four minerals, felspar, hornblende, garnets and quartz.

True granite, composed of felspar, quartz and mica, is not of rare occurrence; it frequently occupies the summits of the highest hills: thus it is seen in some of the Koondah range, and of the Doodabetta group; I never saw it, except in the form of erratic blocks, in the low valleys (No. 32). In those places it has the usual appearance of immense masses, split by vertical and horizontal fissures, into columnar or prismatic figures; they, however, no where assume the tor-like

* It would be worth enquiring whether the laterite, mentioned by Dr. Christie as occupying both the coast and the summits of the ghauts, be of the same composition and nature; because in his account of this rock it seems that he is describing a conglomerate rock; particularly that in the Darwar district, where he says that, at the summit of the ghauts, the rock is found; is it associated with the hæmatitic iron ore, as well as on the Neelgherries?

† Mr. James Prinsep pronounces this to be decidedly an ore of manganese.—Ed.

appearance so common in the granitic hills in other parts of India. The granite occasionally is of a dull, yellowish brown colour, owing to the felspar, which assumes that tint, resembling in that state the *feuille morte* of the French. Doctor HARDY has remarked the same change of colour in the granite of Mewar.

The other species of granite, found always associated with the former, is the pegmatite (No. 33), a rock composed of only two minerals, felspar and quartz. The places where I have found this rock *in situ* are marked in the map: it is a variety of the graphic granite; in aspect very different from the same rock found in other parts of Southern India, in which the quartz is regularly crystallized, and the felspar in long slender crystals, of a pale flesh colour.

In the variety of this rock on the Neelgherries, the felspar is milk-white, lamellar; but not in regular prismatic crystals: the quartz is occasionally of a smoky colour or bluish; and in angular pieces, this colour is sometimes so deep as to appear nearly black. In some of the masses are occasionally seen a few garnets, or a little hornblende; but, in general, the rock is exclusively composed of the two minerals, felspar and quartz*.

Of this rock some erratic blocks are seen in the valleys, at the foot of those hills, the summits of which contain it *in situ:* this is the case in the Kaitee valley, whither many of these boulders have been probably hurled down either from the summit of Doodabetta, or from the Kaitee peak, where pegmatite is found.

It is undoubtedly from the decomposition of these masses, that the porcelain earth, described in the beginning of this Memoir, arises. By comparing specimens of the two, their identity is established.

The sienitic granite varies in the proportion of its component minerals, and therefore in appearance; sometimes approaching diabase (primitive greenstone), and at others, granite (No. 33½). It almost always contains garnets as one of the minerals composing it; and when this mineral is abundant in the rock, the quartz diminishes in proportion. In the Doodabetta group, I have remarked, in some places, the garnets, instead of being either amorphous, or in angular crystallized pieces, assume the granular form, resembling colophonite; in which case, the rock containing it assumes a stratified appearance (No. 34), and at others being lamellar, and of the dodecahedral species; in this case, it resembles cinnamon-stone, or essonite.

The hills, confining the valley of Kaitee, being formed of rocks containing curious and rare varieties of minerals, possess, to the eye of the

* This species of granite seems to be very common in many parts of India.—Dr. HARDY appears to describe it in many localities, in his sketch of the Geology of Central India. Many of the blocks jutting up in the plain between Palaveram and Madras, such as that near the Race Course, are all pegmatite.

geologist and mineralogist, such a degree of interest, that I hope to be excused if I give a detailed description of its geological features, and that I may tire the reader less, I will do it in the form of a geological itinerary.

Leaving Ootacamund, and taking the new road to Koonoor, after two miles we come to a gorge, formed by two ranges of hills ; the one to the left (N) being the loftiest, and the most abrupt of the two ; whose precipitous façade, overhanging the road, is not less than six or seven hundred feet above it. The view from this gorge is really beautiful, and particularly pleasing to the eye, on account of its more extended cultivation—a very rare sight among these hills.

This valley is enclosed between two ranges of hills, both having nearly the same direction of N. W. and S. E. ; and each having the form of an obtuse angle, the upper and shorter side forming the boundary of the head of the valley. On account of their direction, I shall call these the *eastern* and *western* ranges. The eastern range is a *diramation** of the Doodabetta group, and, rising from its southern side, divides itself into two chains ; the one takes a southern direction, and, after a mile or two, ends in the vertical peak of Kaitee pass, of which it forms the northern side. The second branch takes a S. E. direction, and, forming the eastern boundary of the valley, stretches about eight miles as far as Koonoor. The declivity of this chain, facing the valley, is rather abrupt and precipitous for some miles, but the northern side slopes into gentle declivities, and the whole chain decreases gradually in height, as it advances towards Koonoor. The western range is the continuation of the right-hand hill of the Kaitee pass, which last, after stretching south for nearly half a mile, makes an obtuse angle, and takes a S. E. direction ; but its new course does not extend two miles, finishing in a gentle slope, when arrived parallel to the Kaitee valley.

The length of this valley, so enclosed between these ranges of hills, as far as the waterfall, may be about five miles, widening as it extends southwards, and being interspersed with numerous undulating hillocks, having the usual tame, rounded outlines, and very few rocks, or masses, jutting above the soil. It is worth remarking that these hillocks are, comparatively, divested of the arboreous vegetation, which invariably occupies the ravines and hollows in other parts of the hills ; but this want is more than compensated, by the pleasant sight of industry and cultivation.

Descending from the Kaitee pass towards the valley, after the second turn of the road, and not a hundred yards from the huge mass which overhangs the road, we come upon a thick vein of quartz, in-

* *Diramation*, from the Italian word *diramato*, we presume. There can be no objection to the employment of the word on the present occasion, as it is so very expressive ; but the excellent author has committed a coinage by using it as an English word.—Editor.

tersecting it nearly in an east and west direction; and, on examination, we see that it contains numerous veins of titaniferous iron ore. It is the same place mentioned in a Note to this Memoir.

The rounded oblong hill, on the sides of which the new road is constructed, and which is intersected by the vein of titaniferous iron ore is formed of the granitic rock, which prevails in all the eastern range, of Kaitee; viz. an unstratified rock, composed of four minerals, in general, hornblende, garnets, felspar and quartz; occasionally, in some masses a few plates of mica (No. 35). This rock, in this locality, as well as in others of the same range, varies, not only in the proportions, but in the number, of these minerals. This is another locality, which proves the constant association of the titaniferous ore with rocks abounding in hornblende.*

The rock decomposes into the usual lithomargic earth, which, it would seem, is the exclusive result of the decomposition of rocks containing much hornblende (No. 36); the presence, or absence, of the other minerals, making hardly any difference. With the exception of a few yards above the road, where the vein of the titaniferous iron cuts the rock, the whole surface of the hill shows no other rock than the above mentioned granite.

The vein of quartz appears to extend from the eastern to the western nullahs; and, although protruding in the eastern side of the hill, it does not reach so high as the surface of the convex summit of the hill. I found in the western nullah some straggling pieces of the same ore.

The breadth of this titaniferous vein is 250 ordinary paces, measured in the cut of the road; and, although evidently unstratified, yet, in some of the masses, particularly those in which there are many veins of the ore, it puts on an appearance of stratification. In general the composition of the vein is this—the quartz is granular, and when mixed with a great quantity of the ore, becomes friable, crumbly, (No. 37) and full of little cavities, the greatest number of which are full of an ochreous, or yellowish earth. But the same rock, in other parts of the vein, assumes a great degree of hardness, although having the same appearance as the friable one, but with less metal (No. 38). The titaniferous iron is contained in thin ramifications through the quartz; in some places alternating in laminar plates of certain thickness with it; in others in thin strata by itself. It is sometimes seen like a black, shining varnish over the surface of the stones; but, chiefly, in thin veins traversing the rock, not exceeding a few lines' thickness (No. 39). Occasionally, between the metal and the quartz, in the seam, there are little irregular cavities, the metallic side being lined sometimes with a most brilliant green, precisely the colour and brilliancy of

* On doit faire remarquer que le titane sphéne est tellement constant dans ce group (sienitique) qu' on le donne comme un caractére empirique à le faire reconnaitre. *Tableau des terrains qui composent l'ecorce du Globe, page* 341.

oxide of uranium ; at others, golden, scarlet, red, or, lastly, it has a jet black, velvety *enduit* (No. 40). The titaniferous iron has a semi-conchoidal fracture—the lustre is adamantine, and, in some of the specimens, glimmering—it scratches glass—alone is infusible before the blowpipe, but forms with borax a reddish globule, in which the particles of the metal are still seen, changed into the same colour—not magnetic, even after the action of the blowpipe. These two last qualities, together with the probability of its containing uranium, would make this metal approach to nigrine or iserine, more than to menaccanite. Judging by what we see in the bank of the road, this metal cannot be scanty in quantity. In this locality I also found two pretty large loose pieces of an iron ore apparently different ; fracture scaly—it shines brilliantly—is powerfully magnetic, and looks like chromate of iron (No. 41).

Leaving this titaniferous vein, and descending towards the farm, having reached a little flat in the road, we see many masses of hornblende rock, which, having been blasted to form the road, show the thick quartz veins of a bluish colour, traversing the rock in all directions (No. 42).

If observations and facts were wanting to prove that the thick mass of lithomargic earth is owing to the decomposed granitic rock of these hills, the following is conclusive. The original undecomposed rock is, as I have said, traversed occasionally by thick veins of quartz. These veins resisting decomposition (which affects the remainder of the ingredients of the rock) are seen *in a continuous course, penetrating from the hard crystalline undecomposed nucleus of the rock into the lithomargic earth, and into the concentric layers of the already decomposed rock.* Therefore, it is impossible to avoid the conclusion, that the red earth and the rock were, at one time, *one mass, traversed by the quartz vein,* which is still seen *continuous* and entire, notwithstanding the transformation of one-half of the rock into red earth. This is to be seen on the N. bank of the road, which descends from Ootacamund to Kaitee valley, after the steepest descent of the Kaitee pass is finished ; and, I dare say, may be found in many other places, which I have had no opportunity of visiting. What I have said of the quartz veins is also applicable to the more numerous felspathic veins, which traverse the rock ; with this difference, that they are decomposed, and converted into porcelain earth, while those of quartz are entire and unchanged. But the *continuity* of the vein is evident, although one-half of it has changed nature.

At the end of the descent, a little way to the right of the road, there are the ruins of what were the Artificers' huts. Here are to be seen many straggling pieces of quartz iron ore (No. 43), and many large masses of the same implanted in the ground. In these last, the rock is

stratified, the strata being composed of the iron ore, alternating, conformably, with others of pure laminar hornblende, in a state of decomposition in some of the masses. But, an appearance worth noting is that the hornblende, in decomposing, maintains its form and splendour, but it has changed colour from black to golden, the texture having become crumbly (No. 44).

Descending along the new road, within a hundred yards of the public bungalow we see, to the left, and close to the road, two large masses of a black looking rock overlaying some strata of a white one. This is the locality, where the common garnets assume the granular form, and resemble colophonite. The diagram (Plate 7, fig. 2) gives an idea of the position and configuration of these masses; which I will describe separately according to their situation from the lowermost to the uppermost.

After having removed two or three feet of earth from the foot of the rock, we see that the lowest is hornblende rock, having a little felspar, but no garnets, and a few grains of quartz (No. 45). All the uncovered portion of the mass is evidently unstratified, and, although the mass itself does not contain garnets, it is traversed by a vein, or probably, part of the block itself, which contains some of them, resembling hornblende porphyry with garnets (No. 46).

The strata overlaying this lowest rock are those which contain the colophonite, being formed of greenish hard hornblende, and numerous granular garnets. This lower stratum of colophonite rock is extremely hard and heavy, having not much hornblende and the garnets not being so granular as in the upper one, but rather foliated (No. 47).

The stratum over this, is not so compact, and the hornblende is greenish and decomposing; but, the colophonite is better developed (No. 48). The upper stratum assumes the compactness and hardness of the lowermost (No. 49). Above there is another thin stratum, not extending all the length of the others, and different in composition from them all, being of a granitic rock, without garnets or hornblende, mica replacing them both (No. 50). This is succeeded by a stratum of whitish rock, different from all the others, being a felspar vein, or rather stratum, in a state of decomposition, with a few grains of hornblende in the same condition; and, here and there, some grains of quartz; plates of mica are not rarely met with (No. 51). This last mentioned stratum is conformable to that of the colophonitic rock, but it has not the numerous fissures, with which all the above mentioned strata are split, perpendicularly to their seams. Although the line of demarcation between the felspathic and colophonitic strata, be decided and well marked, yet the lower portion of the felspathic rock imbeds some oblong or angular pieces of the colophonitic rock. With regard to the dimensions of all these strata, the three of the colophonite may have five feet thickness, that of the felspathic rock hardly two.

All the above mentioned stratified rocks are overlayed by an enormous unstratified black mass, the composition of which approaches hornblende porphyry; although in some portions it loses the garnets altogether, or, at least, they become very rare, and the quantity of felspar increases in proportion (No. 52). This superincumbent rock, when decomposing, exfoliates concentrically, passing through the usual stages of that process, observed in rocks of similar composition on these hills (No. 53). The mass, to the right of this large block, overlays nearly the same strata as the last; but the soil in this, reaching higher than in the former, prevents the sight of the colophonitic rocks which underlay it. All the rocks scattered on, or implanted in, the soil about this place, are either of quaternary granite or of hornblende rock.

As I said before, rocks being unfrequent, in the lower parts of the whole extent of Kaitee Valley, except some loose blocks at the foot of the two chains of hills, which confine it, I think that to have a correct idea of the rocks of this locality, we must describe these two ranges of hills separately.

Going from Ootacamund towards Kaitee, and reaching the last houses of the Cantonment, at the little gorge, a path is seen to the left, which leads to the summit of Doodabetta; after ascending a few hundred yards, to the right we see three small villages, near the ravine, through which a road leads to the gap, between the summit of Doodabetta and the southern branch of Kaitee, which ends in the bluff precipice of the pass. Passing a mile beyond these native villages, called Mantoo, we see, close to the road, and extending further along the declivity of the hill to the left, large masses of cavernous, hæmatitic iron ore, similar to that of Scotland Valley (No. 54). This bed is but a few yards thick, and the rock, although in general scabrous and porous, is compact and with a glimmering fracture in some of the blocks; then assuming the appearance of real hæmatite (No. 55). The direction of this ore is N. and S. and it does not seem to extend very far either way; being flanked, particularly at the eastern side, by a beautiful hornblende porphyry with garnets (No. 56), which, however, on the western side, losing the garnets, becomes hornblende rock (No. 57).

Arriving at the gorge, where the two ramifications of the Kaitee group divide, and leaving Doodabetta to the left, we follow the eastern range of Kaitee, the precipitous faces of which look into Kaitee Valley, and we see that the first of them, particularly its summit, is formed of granite, abounding with quartz; the other minerals being mica, felspar, and a few garnets (No. 58). The colour of this granite is similar to the *feuille morte* of the Doodabetta group (No. 59), and, like it, is traversed by, or passes into, pegmatite (No. 60). In the next hill, the western precipitous face is formed of pegmatite, which, in this place, is flanked by granite, abounding in mica (No. 61).

In the hollow, which intervenes between this and the next hill, are seen some loose blocks of basalt, whose fracture is glimmering; it decomposes into the usual yellow ferruginous clay (No. 62). The awful precipice of the next mountain, facing Kaitee Valley, is formed of the same rock as the first; but the granite, particularly on the sides, abounds more with mica than the first (No. 63); and, in those blocks where the last mentioned mineral is in large quantities, the garnets disappear (No. 64).

The formation of these hills, from this place to the Farm, is the same as what we have just described, with the exception that, when arrived half way down the descent towards the bungalow, on the convexity of the hill, we meet with a basaltic dyke (just above the Burghar's village called Koondatyippa), which cuts the declivity of the hill in a direction N. E. and S. W., from the eastern ravine, where the village stands, to the one where the colophonitic rock is found. The outgoings of this trap, are basaltic hornblende, with a glimmering fracture, on account of the small needle-shaped crystals of augite it contains (No. 65). This basalt decomposes into the usual clay, so often mentioned (No. 66). It is more than probable, that the erratic blocks of trap, found in the ravines and low flats of this valley, chiefly proceed from this dyke. On both sides of this trap, the projecting rocks are of the granite, which forms all the hills in the vicinity, and the basalt does not seem to extend further than the ravine, close to, and east of, the masses of the colophonitic rock.

Returning to the Kaitee pass, if, instead of descending, we turn to the right, after a few hundred yards, we come to a huge rounded mass of rock, forming the summit of the hill on the south side of the pass. This is the commencement of the range, which is in the same direction as Kaitee's southern ridge (or rather, it diverges a little to N. E. and S. W.), and so shutting the head of the valley to the N. W. This little range is formed of two hills only, having the same height as, or perhaps greater than, that of the Kaitee eastern chain. Merely looking to the mass, which crowns this hill, a geologist sees, at once, that the rock must be granitic, by its being split in all directions, by numerous, irregular fissures, dividing the surface into rhombs, cubes, and all sorts of angular figures. The composition of the rock is the usual aggregate of felspar, hornblende, garnets, quartz, and a few plates of mica (No. 67). This last mineral is not so constant an ingredient as the others; and when the rock loses also the garnets, it becomes sienitic granite, which is found near the summit, and in loose masses on the declivity of these two hills. But in the highest parts of the first hill, the rock has no hornblende, and the felspar, assuming the colour of faded leaf, becomes

perfectly similar to that of the summit of Doodabetta, and associated like it, also, with beds of pegmatite (No. 68).

In the hollow, which divides this from the next hill, we see large masses of sienitic granite and hornblende slate (No. 69), in which last rock the hornblende forms separate strata, alternating conformably with those of felspar. Many of the blocks in the precipitous face of this hill, facing the valley, are sienitic granite, in which hornblende abounds. But, at its summit, the masses are hornblende slate, some of them nearly vertical, their direction being that of the ridge itself.

Descending into the hollow, at the head of Kaitee Valley, we find numerous large masses of a granitic rock, in which it is interesting to observe some portions of them entirely composed of sienite, and others of regular granite ; in both kinds the felspar being red. Many other masses (loose) were formed of a fine grained greenstone, which, when struck, rung powerfully.

From the head of the valley, the view is magnificent ; perhaps more so than that from the pass. The direction of the valley is E. S. E. and W. N. W. Descending towards the Kaitee farm, at the foot of this second hill, we meet with numerous basaltic boulders, both loose and implanted, very probably the outgoings of some dyke (No. 70).

If instead of descending into the valley, we turn from its head towards the west, we come up to the continuation of the just described hills, which, having made a turn eastwardly, continue for a few miles in a sloping manner (forming, however, in two or three places, bluff precipices towards the valley) and terminate, as I said before, parallel to the Kaitee farm.

The rock composing these hills is granitic, perhaps more decidedly so than that of the summit of the hills, forming the head of Kaitee valley. It contains hardly any hornblende, but a good deal of mica (No. 71). At the foot of the highest of these hills, there is an enormous mass, the apex of which overhangs the base. It is composed of an assemblage of stratified rocks, different in composition, the most abundant amongst which is pegmatite (No. 72), and hornblende slate is the next ; the prevailing mineral in this last mentioned rock being of a greenish colour (No. 73).

To finish the description of the whole valley of Kaitee, it only remains to say a few words, regarding the tract which extends from the farm to the waterfall. This cascade is about four miles from the farm, and is formed by a small river, resulting from the waters of the valley. I have mentioned before, that this valley, although undulated with numerous eminences and hillocks, offers a very poor field for the geologist, their surface being uniformly covered by a thick stratum of red earth, and all rocks and asperities in the formations concealed beneath this stratum, which gives them all a tame, smooth aspect.

Following the course of the river, within a quarter of a mile of the waterfall, we meet with immense tabular masses, slightly convex, of hornblende slate, scarcely above the level of the soil, over the middle of which the water of the river flows. The strata are nearly vertical at this place, and the water has cut a passage in them, making a kind of trough. This has not been effected by the mere erosion of the rock by the water, but by its displacement in the following way.

The strata are vertical, and their direction seems in a line with the course of the water, the action of which must tend to widen them; and this rock being intersected, as it is almost everywhere in these hills, by numerous fissures perpendicular to the seams, square, rhomboid, or angular pieces, being loosened, are carried away, leaving the space, occupied by the parallel strata, empty, and, therefore, trough-like with parallel sides. But, although the formation of this oblong cavity is chiefly owing to the cause above assigned, yet the corroding action of the water, charged with pebbles and sand, is contributing likewise to the work of destruction; since, this trough is a little wider at the lower part than near the brim, on account of this part being subject to the corroding action of the water the whole year round, while the upper part is so only during the monsoon time. The dimensions of this excavation are the following: depth six feet—breadth, which is uniform in all its length, six feet and a half—length, ninety two feet. The rock as I said, in which this excavation is seen, is hornblende slate, composed of hornblende, glassy felspar and a little quartz (No. 74).

On arriving at the waterfall, the ledges forming the steps, down which the water precipitates itself, are clearly stratified; there are two cascades, a very romantic parterre intervening between the two. It seems that this last spacious ledge is formed by immense tabular masses, or strata, placed in a horizontal position; while those, which recede perhaps a hundred feet back, and then rise abruptly two hundred feet or more, forming the walls of the first fall, are vertical, and in them there is an excavation, similar to the one already described; its depth being ten feet, but its length not exceeding one half of the former; specimen (No. 75) is from its side, which is the usual hornblende slate. Among these strata, some are composed of two minerals, and some are entirely formed of hornblende; while it is not rare to find some of felspar alone. In all these cases, the strata are intersected by veins of quartz, and, judging from the appearance at a little distance, it seems that the precipitous sides of both the hills, forming the gorge facing Koonoor through which the cascade falls, are of the same slaty formation as the masses of the waterfall. With the exception of some basaltic boulders, implanted in the soil at the summit of the left hand hill, I saw no other rock in the vicinity of this cascade (No. 76).

The rock which prevails in the Kaitee range, as well as in other places,

is the one which abounds with hornblende and amorphous garnets. These last sometimes are of a large size, and not dispersed through the rock, but, as it were, in nests (No. 77). This rock is very like a specimen in the museum of the Asiatic Society of Bengal from Norway, marked " large garnets in hornblende." Indeed, I think that there is great analogy between the *sienite zirconienne* of Norway and this rock of the Neelgherries (No. 78). I remarked in one place of the Doodabetta group some veins containing quartz and garnets ; the last in the granular or resinitic form (No. 79).

Before dismissing the subject of the hornblende rock, I must remark, that although this primitive greenstone is occasionally seen on the summit of some hills, in general it occupies the declivities or the lowest parts of them ; and it often assumes a brilliant, laminar crystallization, being then exclusively formed of hornblende (No. 80). I have seen it passing into hornblende slate at the foot of the Neelgherries, at the bottom of the Koonoor pass. Here its strata dip to the east, and I am informed, that the same stratified rock is found at the foot of the same group of hills, to the west, the strata in that place dipping west. It is in those places that this rock occasionally passes into sienitic gneiss.

The Seven Kairn's Hill—Cinnamon-stone.—As I mentioned in a former paragraph of these pages that garnets, which abound in the rocks of the Neelgherries, sometimes assume the granular form, and, at others, the lamellar structure, striated, and breaking easily " parallel to the plane of the rhombic dodecahedron," I will point out the only place where I found a mineral resembling, in many respects, cinnamon-stone. I regret not to be able to compare it with the mineral from Ceylon, in my collection, which is at Madras.

Due north, and about six miles in a straight line from Ootacamund, there is a high hill, having a ridgy summit, running N. W. and S. E. along which seven Kairns, in a line, are erected. At the western foot of this hill, two rivers join, the one from the hills north of Ootacamund, and the other from the S. W. which, having become one, direct their course eastwardly.

Going from Ootacamund, towards this Seven Kairn's hill, a few hundred paces before the junction of these two rivers, a little to the right of the path, we see a small knoll, forty or fifty feet above the level of the river, extending from the S. W. On the uppermost convexity of this knoll, are erected two enclosures for cattle, now probably deserted, no human habitation, for miles round the place, being seen.

The floor of these enclosures is formed by an immense ledge of rock, which, in their interior, is level with the soil, and on the outside, rises a few inches above it. The rock appears unstratified, at least what is

visible of it, and its composition is the following: lamellar garnets, some of them half an inch in diameter, which, as I have said, have the appearance of the dodecahedral species of that mineral—cinnamon-stone, or essonite ? (No. 81). Their number is such, that entire portions of the rock are formed almost exclusively of them. Next to this mineral in quantity is hornblende, in well-formed large crystals, laminar in its structure, and of a shining aspect; to these is added a small quantity of a granular grey coloured felspar, and a few plates of mica (No. 82). These minerals are not uniformly disseminated through the substance of the rock, particularly the cinnamon-stone and the hornblende, which are contained in large separate crystals, imbedded in a paste, composed of compact felspar and hornblende; and it is to be remarked, that the presence of the four minerals is not always constant in the rock; since in some portions it contains hardly any other mineral than foliated, brilliant hornblende (No. 83).

Of all these minerals it seems that the cinnamon-stone is the most liable to decompose, or disintegrate; since we see, in some parts of the surface of the mass, small cavities, in consequence of the falling out of the disintegrated crystals of this mineral. This rock is very compact, exceedingly heavy and takes a brilliant polish.

These are all the rocks I have met with on the Neelgherries, of which their extensive plateau is formed, and the relative position of which can often only be surmised, on account of the thick covering of soil, and of red earth, which conceals the rock generally.

I must in the last place notice the numerous basaltic dykes, which burst up through all these rocks indiscriminately, without, however, overlaying them, except in one situation; and even there the basalt only forms a small ridge, flanked by the fundamental rock.

I shall describe briefly those places where I have had opportunity of examining this rock; and first, that in the Koonoor pass. Not more than a mile from the bridge down the pass, and just below the village of Koonoor, in the road, many of the blocks which have been blasted, are traversed by a dyke of basalt. In the little ravine close to the road, the dyke is seen *in situ* through the masses of granite in the jungle. This dyke divides into two or three branches, inclosing betwixt them the granite; then it is seen continuing in a north direction, till close to the huts of the village. The projecting masses through the soil indicate the direction of the thick dyke, which in a place near the road is divided into well marked prisms above the granite (No. 84).

This basalt is very compact; has a dull, even fracture; but, in one portion of the dyke, I had the opportunity of observing that the part which was in contact with the granite had the appearance of a crystalline hornblende, which passed into compact hard basalt towards

the centre of the dyke. I also remarked, that where the dyke was in contact with the granite, the basalt was projecting in a small ridge, which was divided into small prisms, as if the consequence of sudden refrigeration and subsequent contraction (No. 85). The masses under the village, exfoliate into concentric laminæ, in which are some needle-shaped shining crystals, probably of augite (No. 86).

Another enormous dyke of this rock is seen in the chain of hills which connects Doodabetta with Kaitee pass. The summit of the hill, which is between those two mountains, is formed of basalt in huge masses, some of which affect the prismatic figure. In general the large blocks are not so compact as the thin ramifications of the dyke traversing the rock, but the hornblende in the former is nearly granular and shining, somewhat approaching primary greenstone.

On the eastern and western slopes of this little ridge, the rock, of which the hill seems formed, is seen in huge projecting masses, so that the basalt does not appear to overlay the rock, but to have burst through it, vertically, in the centre of the ridge.

Going along the ridge from N. to S. after passing a little hollow, we ascend the hill, the summit of which is basaltic. The first intimation we have of the existence of this rock, is seeing many of the blocks of pegmatite traversed in all directions by a reticulated infiltration of basaltic matter (No. 87). On looking at the surface of the blocks level with the soil, we see it divided into irregular portions by the ramifications of the dyke.

Examining some of these masses, we see evidently that, in many of them, the thickness of the dyke diminishes as it proceeds upwardly, and therefore showing the injection of the basalt to have taken place from below. The following appearance exhibited by one of the blocks, shows clearly this direction of the basalt. It is a large mass of pegmatite exfoliating in thick laminæ. Portions of one of these had been removed, either by disintegration or otherwise; the remainder (perhaps a foot thick) was still overlaying the nucleus of the rock, which was nearly level with the soil. A basaltic dyke, an inch thick, was observed in the nucleus of the rock, which had been denuded of a portion of the laminæ; but this dyke did not penetrate into the upper remaining portion of the laminæ, which was incumbent on it. This dyke continued evidently under the remaining portion of this laminæ in the nucleus of the rock.

Basaltic Dykes—Neddiwattum Road.—About two miles from Ootacamund along the Neddiwattum road, there is a small rivulet, close to the road, the first we meet in this direction. A basaltic dyke, like a ledge, half in the water and half out, is seen in an oblique position, N. E. and S. W. dipping north. I shall term this the *rivulet dyke*, to dis-

tinguish it from the other three further on. The exposed portion of this dyke, does not extend more than half a mile N. E. of the rivulet, as its outgoings show clearly. Its texture is very compact and tough; fracture glimmering (No. 88). Following the outgoings of this basalt eastwardly, about a hundred yards further up we see many of them decomposed, through their whole bulk, into the so often mentioned yellow ferruginous clay; while in others the decomposition has not penetrated so deep (No. 89). What the thickness of this dyke is, cannot be ascertained, its lower portion being under water. Above this dyke the numerous projecting masses, at the foot of the hill, are all sienitic granite (No. 90), which occupies also the hills on the S. W. of the rivulet.

On ascending to the summit of this hill, which extends in the usual rounded form eastward, we see that it is entirely formed of basalt, in a dyke probably a diramation of that of the rivulet, and extends all along the small ridge for nearly a quarter of a mile (No. 91). This dyke is thicker than the former one; many loose masses, detached from it, lay scattered along the ridge of the hillock, and on the small eminence near the road. Descending the north declivity of this same hillock, the masses on its surface are sienitic granite, and, at the foot of the other side, basalt again appears. So that it appears that these three dykes, or, more probably, three ramifications of the same trunk, have entangled the sienitic granite of this hill betwixt their diramations.

Proceeding still north after about two hundred yards, we meet with another dyke, through which the road has been cut, and, judging by its proximity and direction, this perhaps is also a branch of the same trunk, as the others in the first hill. Its direction is the same, but the dimensions in this last are on a larger scale. In this dyke the basalt is more compact and has a duller fracture (No. 92); although in some parts it is glimmering, on account of the usual admixture of small microscopic crystals of augite (No. 93). This dyke has, at its western extremity, that is near the road, a breadth of three yards; of course, I am speaking of the trunk, because, as it advances eastward, it gives out numerous ramifications, shooting in all directions, one of which branches off nearly at right angles with the trunk, and traverses the eastern termination of the little ridgy summit of the second hill (No. 94); and it is near this transverse branch, that the sienitic granite contains, in some blocks, large crystals of foliated hornblende (No. 95). It is impossible to give an adequate idea of the intricate, net-like ramifications of this fourth dyke through the sienitic granite, in all possible directions, entangling occasionally numerous pieces of it, and at times insinuating itself, strata-like, in its

substance (Nos. 96 and 97). In the map, these dykes are marked in their proper places.

At the eastern end of this second hillock many of the masses are of a very coarse, almost porphyritic, species of granite (No. 98). Some of the hills between this locality, and what I call Seven Kairn's hill, are of a quaternary granite, that is felspar, quartz, garnets and mica (No. 98½), and, losing occasionally the garnets, they become common granite (No. 99).

About half a mile before reaching the ford of the Pykarra on the road from Ootacamund to Neddiwattum, we see a thick quartz-vein, so common in the Neelgherry rocks, but differing from them all, in containing a good deal of talc, the only place where I have found that mineral on these hills (No. 100). The quartz in this vein is white and transparent, occasionally disintegrating into granular (No. 101).

The same observation made when speaking of the Kaitee dyke, is also applicable to this: the small basaltic veins have a compact, and dull texture, while the body of the dyke itself has a granular structure, somewhat shining (No. 102).

Basaltic dykes are not rare in those places, which I have had an opportunity of visiting in the plains of India. I have seen them through granite and gneiss in Mysore; through porphyry, near the euritic hill of Pallicondah; through hornblende slate, near Mateepolliam; through porphyry, near Garabunda (Northern Circars), and in many other places. Are these dykes the fissures through which the enormous mass of trap, overlaying most of the rocks of the peninsula, burst up? and which subsequent events and revolutions having removed, the vents, only, through which it was forced up, remain to be seen?

It is a well-ascertained fact that the structure, if not the nature, of rocks in contact with the basaltic dykes, is often greatly changed or modified. I saw nothing of this alteration in the rocks close to the dykes I have been describing. The specimen I send, shews no other change, except a slight diminution of cohesion among the composing minerals, and that not in a very marked manner, nor in every locality.

Leaving the Cantonment to go to the Avalanche bungalow, on passing the bund of the lake, we must not omit examining the huge masses of hornblende rock close to it. They shew in the clearest manner the progressive stages, through which the rock passes before becoming lithomargic earth. These masses being split by blasting, we are able to see at once the crystalline nucleus of the rock, together with its state in all the progressive stages which it passes through. I must make a remark regarding the breaking and blasting of the two rocks, the hornblende rock and the hornblende slate, on these hills, particularly the slate that has either very few or no garnets. When the latter is broken pretty deep into its substance, the texture of its crystalline composition is

uniformly of the same colour and composition as the hornblende rock, the strata (except they be of felspar or quartz, or of both) are not distinguishable in the crystalline fracture ; the stratification is seen when the minerals are exposed to the action of the atmosphere or decomposed. In this state they are so clearly and so decidedly marked, that one would hardly believe the decomposed to belong to the same rock as the crystalline. Even in the greenstone itself, though apparently an intimate, uniform and unstratified assemblage of two minerals, when converted into lithomargic earth, the felspar is rendered more discernible, not only when mixed with the hornblende, but also forming intricate reticulations through the rock, which were not visible in its former crystalline state.

We see the first change to be in the colour of the stone some inches into its substance, which, while still compact, has assumed a white circle of some inches thickness, produced by the felspar becoming opaque and losing its compactness. In the circle which follows, encompassing the first, and which I call the second stage of decomposition, the rock has lost a good deal of its compactness, retaining, however, enough to be occasionally employed for temporary architectural purposes (No. 103). The thickness, to which this second stage of decomposition reaches in the substance of the stone, varies exceedingly, from a few lines to many feet ; and, in the majority of instances, it pervades the whole mass, whatever may be its volume. When this happens the whole block not only proceeds to the second stage of decomposition, but passes into the third, or lithomargic earth. These three different stages are seen, in the most distinct way, near the bund.

I cannot omit mentioning, in this place, the mistake committed by many persons in taking for laterite, these rocks both in the second and the third stage of decomposition ; the one in the compact state, the other in the decomposed— an idea, which has embarrassed geologists regarding this rock peculiar to India, and will continue to embarrass them, so long as people, who ought to know the importance of giving a correct name to facts and to things in all sciences, particularly in geology, will not take the trouble to multiply observations, and are careless in the discrimination of rocks, considering two substances analogous, because of a similarity in colour or texture. We hope that our Secretary, who appears to have taken up the subject earnestly, will have opportunities and facts offered to him to dispel the ambiguity which rests on this subject. I have already given my opinion on this intricate question.

Following the Koondah road, in less than a mile we come upon the continuation of the magnetic iron ore, which, intersecting the lake, extends to this place, very much altered in appearance and composition, looking more like a stratified ferruginous sandstone, than the continu-

ation of the metallic vein near the lake, many of the strata being contorted and waving (No. 104), and containing hardly any metal.

Less than a mile further on, the road has cut through a not very thick stratum of pebbly detritus of the hæmatitic iron ore, agglutinated by a clayey paste, and converted into a pisiform iron ore (No. 105). The masses, from disintegration of which this rounded detritus originated, are seen on the road a little further on, and also in the declivity of the hill close to it.

Before we come to the little jungle, some miles from this place, the hill to the right of the road has many blocks of this lateritic iron ore, the greatest number of which are become very like lithomargic earth. After passing the jungle we come to the head of the descent to the Elephant valley.* In this place we see numerous masses of the lateritic iron ore, having an east and west direction, the appearance, fracture, cavernosity and compactness, being analogous to that of Scotland valley (No. 106). It extends east as far as the one Kairn hill (about half a mile) and to the west it is probably connected with the iron ore of Scotland valley.

Half way down the descent we meet with both loose and fixed blocks and pieces of magnetic iron ore, the quartz being granular and brown, without much metal (No. 107).

Arriving at the foot of the descent and fording the rivulet, the country begins to be rather level, strewed with an immense number of loose pieces of quartz and felspar, resulting from the disintegration of the veins of those minerals which accompany invariably the primitive rocks, not only of the Neelgherries, but nearly of all India—the enclosing rock decaying, the quartzy veins disintegrate, and are scattered over the soil (No. 108).

Just before reaching the large stream, about a couple of miles farther on, we see the huge outgoings of such a bed of quartz as those just alluded to, of a snow-white colour (No. 109), its direction being N. W. and S. E. and which evidently has been imbedded in sienitic granite, the thick decomposed laminæ of which are still surrounding the lower portions of these quartz masses.

The little ascent, close to Nungengode, is covered with the same pieces of quartz, and the hill to the left of the road is sienitic granite, passing occasionally into hornblende rock. The hillock on which Nungengode stands is the same rock; but in such a state of decomposition as to form a clayey hill.

About two or three miles after passing Nungengode, we come to a hut, which, I think, is called the *half way house*, having a little enclosure for cattle near it. All the ground just below it, and probably for

* So called because a tame elephant died there.

some miles round, is bestrewed with blocks and pieces of magnetic iron ore (No. 110); and, between this place and the moderately large river further west, not only this species of iron ore, but the lateritic kind also, are seen in numerous pieces on the soil.

Four or five miles further west, just before fording the largest torrent in this road, we see a small ridge of whitish rocks, not more than five or six feet above the ground, formed by a thick bed of quartz rock, running in a direction E. and W., traversing the river, many of the blocks jutting above its waters, and extending half a mile west beyond it. It is a bed of granular, or rather columnar, quartz, containing titaniferous iron, somewhat like the one in the Kaitee descent (No. 111), although the quartz is not so friable, nor the titanium so abundant.

The waters about this ore seem strongly impregnated with iron; since the rivulet, which runs near it, deposits in its course a good deal of an ochreous earth, and the little pools of stagnating water, in its vicinity, have the ferruginous irridescent film on their surface.

The prevailing rocks are now hornblende slate and sienitic granite. All the hills have a rounded contour, and, in the sections for the road, the usual detritus of the decomposed rock is seen everywhere. In some of the blocks near the Avalanche, the decomposition of the rock into the first stage penetrates so deep, that, if the geologist is satisfied by breaking a superficial piece from the mass, he may be led into error regarding the composition of the rock. The pisiform iron ore is not rare in all this tract of country (No. 112); I mean the conglomerate resulting from the agglutination of rounded pieces of the hæmatitic iron ore.

In the bed of the river, about half a mile from the Avalanche bungalow, the masses imbedded are granitic, composed of four minerals, felspar, quartz, garnets and hornblende; this last being in some blocks replaced by mica (No. 113). All the angular pyramidal masses, near the bungalow, are of the same kind of granite (No. 114).

Eastern Koondah Ghaut—Avalanche—Himigala Hills.—Leaving the Avalanche bungalow, to go to the new road above it, and following the path which descends from the stables, about fifty yards onwards, we ford the rivulet which conveys all the waters collected in the large ravine descending from the eastern Koondah pass. Crossing the field we see a little knoll traversed by a basaltic dyke in an east and west direction (No. 115); it is flanked by, and has burst through, sienitic granite (No. 116).

Crossing the road, and ascending the ridge opposite to the Avalanche, this landslip comes at once to view. There has evidently been no sinking of the land in the declivity of the hill, but it seems that a thick stratum of the rock, lying nearly vertically on the declivity of the hill

and between which and another the present rivulet runs, whose waters having undermined the stratum (which might have overlaid thick beds of clay, the result of the decomposed rock) the weight of the superincumbent mass, together with the almost vertical position of the stratum, made it *slip*—hurling rock, soil and jungle into the valley below, leaving a deep ravine, bounded to the north by a mural precipice of undecomposed rock, some hundred feet high, and to the south by the remainder of the declivity, which is seen undisturbed in its place, having the same altitude as the opposite boundary.

Sinkings in the soil about this place do not appear to be a rare occurrence; since in the declivity of the hill on which I stood, there was one of a semi-circular form, many hundred feet in circumference, and of which the *affaissement* of the soil was hardly a foot; and I could descry a larger one, on the northern declivity of the Avalanche hill, where, the slope of the ground being rather steep, the depth of the sinking was greater at the upper than at the lower part.

Returning to the road I began ascending the ghaut. The view from all points of this ascent is really grand. I do not recollect having seen anywhere such a wild, yet magnificent, spectacle as the ravine formed by the two hills—the one of the Avalanche chain, the other one of the eastern range of the Koondahs. The thick impervious jungle, extending its whole length, occupies also the lower half of the steep declivity of both the hills, and is then succeeded by the usual carpet-like covering of dense turf, which extends to the very pinnacles of their prodigious altitudes.

Before I had an opportunity of visiting the Koondahs, judging by their outlines as seen from Ootacamund, I surmised that their sharp peaked profile indicated granite as their formation rock. But, on a nearer approach, it is seen that this appearance is fallacious; since this eastern range of the Koondahs has in reality the same rounded form as the other hills in the Neelgherry group, so as to be as easy of access, even on horseback.

While ascending this pass, at every turn of the road a most striking and superb *coup d'œil* presents itself—the nearly vertical side of the Avalanche hill, with its precipitous battlement-like summit—the enormous prismatic masses, three or four in number, bursting, as it were, through the turf-covered soil of the steep declivity of the hill; one of which, in particular, looks like a huge martello-tower stuck to the nearly vertical side of the mountain—while the magnificent ravine to the left completes the striking view before us. This assemblage of wild and grand objects, cannot but produce sensations of wonder and admiration.

On arriving at the gorge of the pass, of course the view, becoming more expanded and enlarged, has a superior degree of beauty, particu-

larly that of the extensive undulated table-land, of which the Doodabetta group to the east, and the Koondah and Himigala ranges to the west, are the boundaries. I say *undulated* table-land, because such is the appearance of that tract of the country, seen from such a height, although many of these apparent undulations have thousands of feet of elevation.

On my pony I ascended, by zigzags the southern side of the Avalanche hill, and having rode within a few yards of the summit, I walked up the remaining distance. The view from it is the *non plus ultra* of this group; but the spot which struck me most was the awful recess to the north, intersected by deep ravines and abrupt escarpments, which join the Avalanche range to that of the Himigala. This wild scene is exceedingly striking, and I thought it the most romantic in the Neelgherries, until I visited Mookoorty, where is to be seen the most inconceivably grand mountain scenery in all these hills, formed by the termination, north, of this same group of the Koondahs.

The rock composing the Avalanche hill is hornblende slate in the declivities (No. 117), which passes into sienitic granite, and to true granite at the summit (No. 118), with much mica. In ascending from the bungalow to the gorge, I observed basaltic dykes, in more than one place, and thick beds of pegmatite (No. 119). But when we ascend from the gorge to the summit of the Avalanche hill, the greatest number of the projecting rocks is granite, mica having entirely replaced hornblende. There is another remark to be made, regarding the composition of the rocks of this group; that, except the few loose boulders at the foot of the hill near the bungalow, they contain hardly any garnets.

Descending from the summit, when more than half way down, I turned to the left to examine the masses of rocks scattered at the foot of the Avalanche. Many of them were granite, but the most numerous were of hornblende slate. Passing the rivulet, which comes down from the Avalanche, and going west a hundred yards, we meet with a basaltic dyke of moderate thickness, having a N. and S. direction. From the top of this hillock where the dyke is, looking north, we see in the opposite hill of the Himigala range, a pretty cascade, which, although of no great dimensions, yet, having such stupendous scenery as a back ground, and the water precipitating itself down eleven steps formed by the strata of hornblende slate, making as many cascades, has, if not a grand, at least a romantic effect.

Judging from the numerous rolled masses of basalt in the bed of the Koondah river, into which the cascades fall, trap must be of frequent occurrence in these hills which join the Avalanche with the Himigala range. And, *apropos* of this last word, is the name derived from the same root as *Himalaya*? It is also curious to observe the coincidence

and striking similitude of the name under which the natives (at least in Hindoostani) call the Avalanche hill, that is *Beejlee-ka-pahar*, the mountain of the lightnings; what a coincidence with the *Acroceraunian* mountains of Epirus!

Descending a mile along the banks of the Koondah river, we join the new road, following which for a little while, I turned to the left, to examine the high ridge which faces the Avalanche bungalow. This chain, called by the English *chamois* hill, on account of the numerous wild goats found in its jungles, and by the natives Himigala, has its origin in the group of the Avalanche hills, and, striking eastwardly, runs about five or six miles, and ends in a very abrupt precipice. The foot of this hill is not more than two or three miles from the bungalow in a straight line. Its foot, facing the Avalanche, is washed by a small river, the protruding rocks in the bed of which are granite (No. 120) composed of felspar, golden mica and a little smoky quartz. It is a fine grained rock, of a greyish black colour on account of the dark hue of the quartz. Many of the masses projecting above the soil on the lowest parts of the hill, close to the rivulet, are also the same rock, but of a coarser grain (No. 121).

Half way up the hill are three large basaltic blocks, implanted in the soil, the fracture of which is glimmering, on account of the numerous needle-shaped crystals of augite entering into its composition (No. 122). A little higher up is a ledge of hornblende slate, placed horizontally, being the continuation of those which form the precipitous termination, to the east of the range. This slate is very characteristic, being composed only of felspar, in small quantities, and of hornblende, without any admixture of either mica or garnets (No. 123).

Close to the jungle, near the summit of the hill, there is a basaltic dyke cutting, nearly in a perpendicular direction, the horizontal strata of this side of the hill, and, at the junction of the two rocks, they mix together, in such an intimate manner, that the line of demarcation is hardly distinguishable (No. 124).

The stratification of this rock is seen clearly, not only in the precipitous face (south), but also at the summit, where the immense tabular masses lie quite horizontally one above the other. At the top of this hill is a thick bed of magnetic iron ore, running east and west (No. 125). There were also scattered here and there on the soil, geodic pieces of bog iron ore (No. 126).

From the Eastern Koondah, or Avalanche, Ghaut, to the Western, or Malabar, Ghaut.—From the gorge above the Avalanche, proceeding westwards, that is, from the eastern to the western ghaut, we see in the sections for the roads the usual geological phenomenon, so often met with on the Neelgherries, the detritus, resulting from the decomposi-

tion of the rock, forming a stratum below the vegetable soil, and overlaying the decomposed rock (No. 127). The only difference here is that the lithomargic, or clayey, state is rarely seen, the whole substance of the rock being changed into a dry, friable, rough substance, somewhat similar to the second stage in the Neelgherries. Another difference in the rocks of this plateau, is the greater frequency of granite than in those of the Neelgherries (No. 128). Besides, the decomposed rock itself is of a different nature to the other; since it has the appearance of being stratified, and, in its second stage of decomposition, is more rough, is full of cavities, and bristled with sharp points, harsh to the touch; while that of the Neelgherries, in the same stage of decomposition, is tolerably compact, and is not very scabrous, at least not in the interior of the decomposed rock.

In more than one place thick beds of black soil underlay the vegetable mould, on the declivities of hills, and always in the low valleys. Five or six miles from the eastern ghaut, we come to a round backed hill, all formed of the lateritic iron ore, precisely similar to that in other localities on these hills (No. 129). In many parts of this hill the iron ore is compact and blistered on the surface, and in such pieces the passage from compact, solid, hard, glimmering hæmatite, into cavernous, perforated stone, perfectly resembling the most characteristic species of laterite, is seen in the clearest manner possible (No. 130).

Descending this hill we come to a valley, which, on account of its great length, is called *Long Valley*. The greater number of blocks jutting above the soil (at this side of the Koondahs the hills have the same rounded appearance as those of the Neelgherries), on both sides of the valley, are schistous diorite, mixed with many others which are granitic, composed of the three usual minerals (No. 131). As we approach the western end of the long valley, trap, either in dykes, or as an overlaying rock, is seen passing through, or lying on, the granitic rock just described (No. 132), besides immense beds of pegmatite, into which the granitic rock occasionally passes (No. 133), and, at the west end of the valley, the granite becomes of a fine texture (No. 134). But, notwithstanding this change in the predominating rock, the hornblende slate and rock are still occasionally seen, forming a hill here and there, such as near the end of the valley, at the place where the waters part on account of the change of level in the country; the diagram (Pl. 7. fig. 2.) shews the face of a hill, nearly vertical, completely naked, in which the stratification of the rock composing it is very apparent, even at a distance, the strata inclined and dipping W. This mass of rock is split by five or six different fissures, and at different angles to the seams, without these last being in the least displaced; and so also a thick quartz vein, which traverses the

whole length of the mass, in a nearly horizontal direction, although traversed in the same way as the strata by the fissures, has not suffered any fault or displacement.

After passing the long valley, the hills to the left have numerous masses of basalt and of basaltic hornblende, either as overlaying rocks, at their summits, or forming black and naked convexities on their sides. And now, nearly all the hills that branch off from a huge mountain mass, a few miles eastward of the termination of the long valley, stretching N. E. and S. W. and ending at the abrupt limits of the Koondahs, near the Devil's Gap, are basaltic, giving to them a form and aspect quite different, not only from those of the Neelgherries, but from those of the first tract of the Koondahs, and even from those which flank this chain of basaltic hills on both sides. Their contour, although rounded in a certain degree, does not proceed from the decomposed rock, as in other parts, but from the enormous, convex, bleak and black masses of trap, which form them, and on which neither grass nor trees grow; in short they clearly show, even at this distance (two or three miles), the diversity of the rock they are formed of. It is nearly all trap, to be described hereafter.

Resuming our itinerary—At the end of the long valley the basalt is seen in dykes, as in the bed of the torrent, or capping the hills (No. 135). From this place until we reach *New England*, all the rocks are granitic, with a good deal of mica (No. 136), in many parts decomposing, not into lithomargic earth but, into a sandy soil mixed with a little clay. In the bed of the river which runs at the eastern end of *New England*, the pegmatitic rock, which is now the predominating surface rock for many miles west, is seen intersected by dykes of basalt, which ramify through it in all directions (No. 137). When I said just now that pegmatite succeeded granite, I meant on the right of the road, chiefly; since the hills to the left are intermixed with a good deal of trap. The little insignificant flat of ten acres, which has been dignified with the name of *New England*, is a small barren spot, on which I doubt whether there is room for a race course! In the road which passes through it there are many masses of pegmatite, level with the ground, intersected in all directions by numerous diramations of basalt, similar to those just passed. Near this place the basaltic dykes have great thickness, and many of them are decomposing, and decomposed, into the yellow ferruginous clay (No. 138). From this place to the Devil's Gap, the country to the right is formed of pegmatite, and, in some places, mica being added, it passes into large grained or porphyritic granite (No. 139).

It is as we approach the Gap that the direction of trap may be seen, forming a black and naked chain of hills, of which the one to the left of the Gap is the western termination. Of the two hills, forming this

wonderful chasm, the one to the right is granitic, having many boulders of trap on the side and at the summit (No. 140); that to the left is basalt, at least from the lower part of the Gap to the summit, decomposing into the yellow clay (No. 141). I say from *the lower part of the Gap*, because on the eastern side it overlays pegmatite.

Not to interrupt the geological itinerary, I postpone describing this extraordinary chasm, until the time arrives for giving an account of the few excursions I made in the neighbourhood of Sispara, while at the head of the Malabar ghaut.

The whole of the hills to the left of the Gap for a mile or two are basaltic, so also those forming the left side of the ravine, along which the road is cut. But after this distance, we come upon a very thick bed of pegmatite, beautifully characteristic, underlaying the basalt of the left hill of the Gap (No. 142). This pegmatite is very hard, and is seen in the section for the road in the greatest perfection; it contains nothing else but milk-white felspar, and quartz of a faint aquamarine colour, with a few nearly microscopic grains of hornblende, which, when decomposed together with the rock, give to the porcelain earth a motled appearance of ochreous specks. This rock continues with a little interruption as far as the beginning of the descent to the Pioneer's Camp. But I must mention, before proceeding to the camp, a most curious and at the same time very characteristic phenomenon, the manner, namely, in which basalt has intruded into the granite of this place.

A mile or two before the descent towards Sispara, to the left of, and between two and three miles from, the road, there is a high hill, having a vertical, naked face towards the road; between it and the hill a ravine, overgrown with jungle, intervenes. In this precipitous façade, which is quite exposed, even at this distance we discern a huge basaltic dyke, which appears to have burst from the base of the hill, intruding into the granite, giving out at the same time numerous ramifications, to the left and right, which intersect the granite with many tortuous, intricate and irregular diramations. The diagram (Pl. 7, fig. 4) will give better idea of the appearance of this intrusion than any description can. These gigantic dykes are seen almost in every hill in this western boundary of the Koondahs. Unfortunately many of them (although distinguished so clearly as not to leave the most distant doubt of their nature) are inaccessible, on account of the impervious jungles which surround them. This is the case with the last mentioned, and with another nearer to Sispara, to the left of the road, in which the dyke shoots up through the middle of the bluff façade of the hill, without giving off any ramifications. The rocks from this place to Sispara are granite, decomposing and decomposed.

As I said that, during the few days we remained at Sispara, I made

several excursions in the neighbourhood, I shall describe their geological features first, and say a few words afterwards on scenery and other subjects.

Going up from Sispara (where the Pioneer's Camp is) three miles along the new road, we come to a deep ravine along which the road passes, and the western end of the same where we found the characteristic pegmatite. Before reaching this we see in the bed of the torrent the implanted pegmatitic masses traversed by trap (No. 143); and half way up the left hill there are some protruding masses of granite (No. 144). Ascending still the rise of this hill, to the little flat at its foot, nearly all the protruding masses are granite (No. 145), the mica predominating; and it appears that these blocks must have been hurled down from the hill just in front; since, although loose boulders, many of them are traversed by basaltic dykes. At the foot of the hill, these blocks, either loose or implanted, exhibited few or more of these dykes. The extensive convex acclivity of this side of the hill (S. W.) is formed by an immense mass of basalt which lays mantle-shaped on its side and, spreading over its summit, caps it also; and, in both places, it entangles stones of granite of different dimensions and shapes.

But the eastern side of this same hill has a different formation. Although the colour, aspect, configuration, &c. of the rock appear similar on both sides, yet there the rock is all granite, of the three usual minerals, the surface of which only differs from the basaltic side in being rough with little prominences and cavities (No. 146). There is an enormous mass of this rock projecting from the sides of the hill, which is cut in an horizontal direction by a basaltic dyke more than a foot thick, and the line of demarcation, between the intruded and the intruding rock, is well and clearly defined (No. 147). Probably the surfaces of both rocks were at one time in the same line, but the upper part of the granitic mass, which overlays the dyke, having exfoliated to some depth, the upper surface of the dyke forms a kind of little shelf.

If, instead of returning to Sispara by the new road, we follow the verge of this group, which terminates at Sispara, we meet with no other rock but granite, the whole way. Sispara, or Murraypet, is at the head of the long and deep ravine, enclosed between two almost perpendicular ridges; along the side of one of which (N. W.) the Ghaut is to be constructed. Lieut. Johnson of the Engineers, makes the absolute height of Sispara about 5,620 feet.

Passing through the huts of the encampment, and ascending the bluff high peak of Sispara, half an hour's walk leads to a mural precipice (the escarpment facing the plains of Malabar), the height of which cannot be seen, on account of the numerous trees growing at the foot of the precipice, but it cannot be much, since the tops of these lofty trees

reached the brim where I was standing. I walked along the edge of this escarpment, until I came to the huge peak-like mass of rock, a few hundred yards from the foot of the highest Sispara summit, which stands like a battlement on a wall. The view from this point is really magnificent, particularly that of the gigantic amphitheatre to the right, the termination of the Koondahs on this side. It is very striking to look at this stupendous semicircular recess, formed by enormously lofty mountains, the summits of which rise vertically to thousands of feet, and whose abrupt sides are deeply corroded by ravines and chasms, down which small but romantic cascades precipitate themselves, adding to the magnificence of this stupendous scenery.

The extraordinary chasm called the *Devil's Gap* is situated nearly in the centre of this semicircle, which however, from the place where I stood, was not visible, but a little further on it must be so, and then the romantic mountain-picture would be complete.

The rocks of all these declivities, as far as the battlement-like mass, are granite, composed of the three usual minerals (No. 148). The composition, however, in some blocks varies, and in others the texture; the rock becoming fine-grained, which alternates, as if in strata, with the coarse-grained species. In this rock, when decomposed, the felspar assumes a very scabrous, cancellated structure, somewhat similar to trachyte, but the quartz remains unchanged, the mica decomposing into an ochreous substance (No. 149). It is not an unfrequent occurrence for mica to be contained, in this granite in nests, besides the portion of it disseminated through the substance of the rock, and which forms an essential constituent of it (No. 150).

We ought not to overlook a most important circumstance in this granitic district, which is that, although the rock is decomposing, it does not form red earth, or lithomargic mould, but a reddish sandy soil; and on these hills, whether basaltic or granitic, although having here and there a stunted kind of vegetation, long rushes alone thrive, and those only in protected places. They have none of the rounded contour of those hills the rock of which, containing a good deal of hornblende, when decomposed, covers them with a thick stratum of lithomargic earth.

The next excursion was to the Gap, which is hardly four miles from Sispara. The lower part of this chasm is nearly level with the road which passes close to it. The rocks forming its walls are inaccessible, and it is therefore difficult to say what is the width of the Gap; but it may be about a hundred yards, since the place where we sat, a little in the rear, and which is wider, was about a hundred and fifty yards.

The view from this Gap calls to mind the mode painters adopt to look at a landscape to advantage, whether a natural or artificial one; that is to say, by placing the open hands to the temples to form a vista, or by

forming a tube, with the hand or a roll of paper, to look through. Nature has done at this Gap, precisely what the painter has found advantageous to simplify the perspective, divesting it of all other lights and objects, which would distract the attention of the beholder from the principal object. The Gap itself forms a paltry view, being too near; but it serves to heighten the beauty of other landscapes and objects, and thus becomes essential to the picture. But, at this spot, there are many points of view, seen through the chasm, that are most wonderfully striking.

From the outside of the pillars forming the Gap we see, jutting down towards the Malabar, two sharp ridges, like balustrades to huge stairs leading to this gigantic doorway, and which, gradually decreasing in height, sink at last in the plains of Malabar.

These plains form one view in the picture, intersected in all possible directions by numerous water-courses, lakes and tanks, which irrigate these extensive tracts, the sight of which relieves the eye from the fatiguing sensation produced by the wild mountain-scenery above.

Another, and perhaps the most picturesque, view, is that of the hills of Malliallum, which intersect a portion of the plain, in humble but pleasing undulations of a bluish colour; the red clouds hovering above, and the blue firmament surrounding them, form a scene of grandeur worthy of the pencil of Claude de Lorraine*.

The geological features of the hills forming the Gap have already been mentioned. That to the left from the base of the Gap to the summit (which may be between five and six hundred feet in both hills), is basaltic overlaying pegmatite. The hill to the right is granite, having numerous dykes and loose boulders of basalt, on its declivities and at the summit.

A question naturally arises at the sight of this vertical chasm, with perfectly parallel sides. Has this Gap been produced by the corrosion of the waters of rivers, charged with detritus, pebbles, blocks and sand? The present conformation of the Koondahs does not warrant such a supposition; the Gap being at a higher level than all the valleys in the group. Even supposing that this spot had been thousands of feet lower than the present level, it is exceedingly improbable that the chasm could have been cut by the erosion of water; because, the edges of the two vertical rocks forming it are sharp and quite parallel, without having the slightest appearance of that smoothness which rocks that have been eroded invariably offer.

The hills east of Sispara are granite (No. 151); notwithstanding

* The annexed is from an etching by Captain Barron taken from a painting he has executed in oils, which exhibits an exact representation of the splendid scene I have attempted to describe.

From the Original in Oils by Captain Barron.

THE DEVIL'S GAP.

Koonda's Malabar Ghaut.

BRITISH MUSEUM
NATURAL HISTORY.

which all the sections for the road show, as I have said before, an apparently stratified rock decomposing, which surrounds and overlays it; this makes me believe that what seem to be strata are only apparently such, and it is very probable that they are small segments of large concentric laminæ, into which the granite has decomposed. Notwithstanding the diversity of the two rocks forming the Sispara group, basalt and granite, it is curious to remark that their external surface has the same black appearance, particularly at a distance, which might induce an error.

Descending along the half finished ghaut, the greatest number of rocks projecting on both sides are granite, similar to that of Muraypet, but of a finer grain ; pegmatite in larger masses associates with it. Lower down the granite acquires, in addition to the three minerals, a few garnets, and it seemed to me as if assuming a certain degree of stratification. The whole length of the precipitous sides of the hill, along which the new road is cut, is traversed by numerous basaltic dykes of enormous dimensions, and, in some places, huge laminæ of it are laid, mantle-shaped, on the nearly vertical sides of the hill, the lowest portions of which, having been detached and hurled down the precipitous declivity, the remaining laminæ are seen holding still to their precarious attachment, ready soon to join the fragments which are seen below scattered about, or heaped in great confusion, near the road.

Descending still, the rock appears to contain more hornblende and more garnets, although in the deep nullahs it has still the granitic composition; the consequence of this additional mineral being their decomposition into a red mould, very nearly similar to that of the Neelgherries.*

As circumstances prevented me from going lower down the ghaut than six miles, I cannot, from personal inspection, say what is the rock which prevails at the bottom of the pass; but, from a specimen brought up by one of our party who descended so far, it appears that garnets are very abundant in the rocks lower down; since the specimen he picked up, from among the splinters of a block just blasted, proved to be an assemblage of garnets with a scanty portion of magnetic iron (No. 152).

I hope to be excused, if in this, as well as in other places, I should mix with the geological observations some paragraphs of personal narrative, or rather descriptions and reflexions suggested by new scenery and new objects, such short digressions, besides relieving the mind from the fatiguing attention demanded by dry scientific subjects, affording information regarding topography, scenery, and other agreeable and interesting matters.

* Dr. Heyne long ago remarked that red soil prevails where sienite forms the apparent ground-rock.—Tracts, etc. page 349.

After having descended this ghaut three or four miles, we see and feel that we are getting by degrees into a different climate. The air is milder, and a little exertion causes perspiration to flow freely. The ground rattans, the arborescent ferns, and the wild plantains, begin to appear. But the most magnificent, stately object amongst the tree tribe is the *Arjoon* of the natives, the winged Terminalia, now almost the exclusive possessor of the jungles. It is one of the most stupendous trees I ever saw, its trunk rising, column-like, to the height of sixty or seventy feet, without giving out a single branch; but when arrived at this altitude, numbers of them shoot out horizontally, at once, in the form of a huge parasol.

These trees grow so close to each other that there is hardly place for underwood to grow, while, by their incredible number, they completely shut out the view of the ravine itself and of the plains of Malabar; the descent is thus rendered monotonous, confined and uninteresting. But the most serious inconvenience *was* the narrowness, and the constant *zigzag* of the road, the first being such that two horses could not go abreast. I said *was* because the moment the Right Honourable the Governor perceived the *quasi* inutility of such means of communication, orders were given to correct the inconvenience. The steepness of the whole face of this hill can hardly be conceived; from Sispara to Wallyghoor, a distance of six miles, there is no place where a tent can be pitched! Wallyghoor is a place, where only a tent or two may be pitched, being about midway down the ghaut, where the camp is at present situated. Having, two years ago, seen what a singularly romantic effect that portion of the Koonoor pass had, where the Pioneers were encamped, I anticipated the same view at Wallyghoor; but I was greatly disappointed.

In this place there being no possibility of erecting them along the road, and the thickness of the trees being so great, the huts were scattered about here and there, where a place could be found under a tree, and, being made of branches and leaves, they could not be distinguished from the brambles and high grass. But, when night came on, the scene changed for the better. It was really romantic and pleasing in the extreme. There were one hundred and fifty people collected there, and at night, before every hut there was a fire, round which numbers were moving about, squalid and livid looking (the effect of the fire-light on a black countenance), busy preparing their victuals; add to this our tents, our horses picketed before them, and the groups of horse-keepers and servants, with many fires blazing on the steep acclivity, which by their light and smoke magnified the gigantic trees around them, and doubled, at the same time, the dark shade betwixt each. What a subject for Gerardo delle Notti, or my countryman Pietro Novelli!

The plains of Malabar offered another striking spectacle, there were numerous fires scattered over all their extent, which I was told were meant to keep wild beasts aloof; these lights, diminishing in size as they receded further, at last looked like stars, and it became difficult to distinguish where the terrestrial lights finished, and where those of the firmament began.

I must be permitted, before concluding this account of the Koondahs, to add a few words on the controversy among geologists, regarding the *insensible passage* of granite into basalt; particularly after having minutely examined this place, which appears to me the most desirable for such an enquiry, as we see the two rocks, not only associated, but mixed together and entangled the one in the other; and, if truly such a metamorphosis exists between the two rocks, it ought to be seen here.

We have seen that in this group basalt traverses and caps granite, having burst from below upwards; therefore it must have appeared on the surface of our planet posterior to the granite, and these two rocks cannot, at any rate, be contemporaneous. It has been inferred, because, in one or two localities, these two rocks *appeared* to pass insensibly one into the other, that they have the same origin, nature and composition, differing only in appearance on account of some adventitious circumstances, and because the one has been erupted before the other. Without entering deep into the question, which would carry us beyond the purpose and limits of this essay, I will only state what my observations have been in the examination of the two rocks in the Koondahs, where, on account of their intimate mixture, if such an insensible transition existed, it ought to be a common occurrence. The only thing I observed, in very few places, was a *mixture* of the two rocks at the points of contact, and which, after all, extended but a few lines, or, at most, an inch or two, on both sides, after which the rocks resumed their respective composition. But even this kind of mixed rock was very rare, and only when the basalt traversed greenstone, or sienitic granite, or hornblende slate; and, for one instance of this kind, I saw a hundred in which the line of demarcation was decided and plainly seen. I suspect that the phenomenon, observed by Dr. Hibbert and Dr. Macculloch, was nothing more than what every geologist sees daily in India, namely the passage of the large grained, laminar, primitive greenstone, into the fine grained species (by some called basaltic hornblende), or the same rock passing into sienitic granite, or into pegmatite.* But I never saw, nor did any of the advocates of the insensible transition ever observe, common granite (such as is found in the Koondahs) metamorphosed into the augitic basalt which prevails there.

* See the paragraph of Dr. Hibbert quoted at length in De la Beche's Geological Manual, page 455, and also Ure's System of Geology, page 123.

Before finishing this geological account of part of the Koondahs, I must ask a question or two, which must have occurred to my readers, while perusing these pages. It regards the decomposition of the basalt, not only in the Koondah, but also in the Neelgherry, groups. We have seen, in the description of the localities where this rock is found, whether as basalt or basaltic hornblende, either intruding as a dyke into rocks, or overlaying them, that, when it arrives at decomposition, it invariably, and in all places, is transformed into yellow ferruginous clay. We have seen and read, also, that, in many parts of the plains of the Carnatic, Northern Circars and Deccan, when the same rock decomposes, an ash coloured, friable clay, or wacke, is formed; and this decomposition takes place in concentric layers. If the two rocks are analogous, whence this difference when decomposed?

Another question seems to me rather of a difficult nature. Since neither sort of basalt, found *at present* in Central and South India, decomposes into a black soil, what kind of trap, and under what circumstances different from the present, could this basalt give rise to such a different product? Is the general opinion of the black soil having resulted from the decomposition of the basalt, one of those that are repeated only because once told? In my humble opinion, these two questions, and that of the distinction of the different rocks included under the general term of *laterite*, ought to engage the labours, the researches and talents of geologists and chemists in India, to remove many doubts in Indian geognosy.*

Reviewing all the facts related in the foregoing pages, we may conclude by a concise comparison between the two groups of mountains. The rocks forming the Koondahs do not contain much hornblende, which deficiency appears to account for the scarcity of the lithomargic earth in this group. The detritus, below the vegetable soil of the Koondahs, has a harsher feel, and is more scabrous than that of the Neelgherries. The second stage of the decomposition in the Koondah rock produces a more crumbly, friable result, than that of the other group. Common granite is the prevailing rock in the Koondahs; basalt comes next in quantity, and pegmatite last. In the only place where I saw the lateritic iron ore, I found it precisely similar, in composition, origin, and geological position, to that of the Neelgherries; that is, hæmatitic iron ore, which, in many of the projecting masses, assumes the cavernous, or the caverno-conglomerate structure, flanked and surrounded by, and imbedded in, the primary rocks. In the Neelgherries, granite of four minerals, sienitic granite, common granite, schistous diorite, pegma-

* We have already an analysis of the black soil of the Southern Mahratta country by Mr. Reid, which makes the composition of the black soil to be very nearly the same as that of basalt.—*Edinburgh New Philosophical Journal*, 1829.

tite, and a few basaltic dykes, constitute the catalogue of the surface rocks in all localities.

To Makoortee.—About five miles W. N. W. from Ootacamund, there is a high conical hill, surmounted by four kairns. The road to Makoortee passes about three miles S. W of this hill, called Pinnapool hill, on account of a small Todar village of that name half way up. On the road to Makoortee, opposite this hill, is a thick bed of magnetic iron ore, forming part of the hill to the left (No. 153). It is stratified, and resembles the vein at the western end of the lake, the quartz being in strata and granular, alternating conformably with those containing the metal.

Proceeding farther west, the masses jutting above the soil are hornblende slate or sienitic granite (No. 154), both rocks having in some places basaltic dykes through them, whether loose or implanted in the ground (No. 155). Leaving this place hornblende slate is the prevailing rock, in which the hornblende is of the large laminar species, with very little felspar (No. 156). About half way between the cantonment and Makoortee, in a valley along which the road passes, is a bed of the usual quartz iron ore, similar to that of Pinnapool, but not magnetic (No. 157). A few miles farther west we come to a Toda Mund, half a mile west of which, we ford one of the tributary branches of the Pykara, all the masses in its bed being hornblende slate abounding with nests of the same mineral (No. 158). After fording the river, the high hill opposite, in a line with the peak of Makoortee, is formed of hornblende slate which passes into sienitic granite (No. 159). This last rock, when decomposed, seen at a distance, is like the lateritic iron ore (No. 160), but not cavernous.

The nearer we go to Makoortee, the clearer the stratification of the rock is seen, and the greater and the deeper the decomposition, so as to display the small but still crystalline nucleus, surrounded by dozens of concentric layers of the decomposed rock. About a mile before reaching the place where the tents were pitched, that is at the foot of the mountain on the summit of which is the peak, we see a bank, perhaps ten or twelve feet high, composed entirely of decomposed hornblende slate, the remaining nucleus of many of the masses remaining *in situ*, crystalline as before, but buried in the numerous concentric layers of their own decomposed substance (No. 161 shews both the nucleus and the decomposed rock). All the masses in the bed of the principal branch of the Pykara, both fixed and loose, are hornblende slate (No. 162). I arrived at Makoortee quite fatigued ; as from an error in the map, I was misled and kept on horseback from 5 o'clock in the morning to the same hour in the evening.

Mr. Viveash, who had been here two days before, informed me of

certain erosions or perforations in a ledge of rocks in the bed of a rivulet, evidently produced by the attrition, or wearing action of pebbles, which, falling in little cavities on the surface of the rock, were by the violent impetus and celerity of the running water, whirled round and tossed about, striking against the walls of the cavity, and so enlarging it, the pebbles themselves having their angles worn off, and becoming rounded.

This phenomenon struck me as exceedingly interesting in a geological point of view, as it may contribute to explain similar appearances found on the summit of mountains in Europe, which have hitherto baffled the ingenuity of some geologists. But although the locality of these perforations was but fifty yards from the tents, I was so tired and exhausted by the long journey, that we postponed the visit for the morrow on our return from the peak. Punctually by 7 o'clock, we were on our ponies and began the ascent.

This undertaking is by no means difficult or fatiguing, although a good deal more so, than the ascent to Doodabetta. We ascended successively three hills, one rising above the other, covered as usual with thick turf, rounded, and quite easy of access even on horseback. After the third hill we came to a slightly sloping table-land, which forms, as it were, a gently rising pedestal to the huge pyramid of the peak. From this place we sent back the ponies, as we intended to descend on foot, and we walked up the insensible ascent to the foot of the peak. My companion and *cicerone*, who had been at the top of the peak the day before, and knew all the points whence the view was most admirable, took me to the gorge at the foot of the south declivity of the highest peak. I say *highest*, because there are two more, besides that seen from the cantonment, which is the loftiest. These peaks and the neighbouring mountains are well marked in the map.

At last we came up to the gorge........What a view! Who can describe in words the scenery which burst all at once on our sight! I doubt much whether even the pencil could give, not an adequate representation, but an approximation to it, of the terrific spectacle that came to view. To the south of where we stood the northern termination of the Koondahs rose in abrupt escarpments and vertical precipices, to the enormous height of 8000 feet, excavated and furrowed by deep ravines. Sharp mural spurs project from their rugged abrupt façades, like so many props for the support of those gigantic walls; some of them, thousands of feet high, have not breadth proportionate to such an altitude; and they decrease, as they shoot upwards, to an oblong sharp edge, forming the summits of these wall-like escarpments.

A sentiment of deep wonder must influence the beholder of such wild solitude and grandeur, rising majestically above the tame, monotonous plains of Malabar. I never saw such impressive mountain scenery be-

fore, Sispara's amphitheatre not excepted, which is too small, too tame and regular, to bear comparison with this.

Having admired this stupendous spectacle, we thought of scaling the peak. I must say a few words of this extraordinary excrescence, which shoots up from the very edge of an abrupt precipice, and raises its perpendicular façade above five hundred feet. On the very brink of the escarpment, which forms the western termination of the Makoortee range, this peak rises, suddenly, in the shape of a cone split into two equal parts from the apex to the base, one half having been hurled down to the plains of Malabar, the other stuck to the brim of the precipice, and having its split façade in a line with the escarpment, like a gigantic battlement.

This abrupt mural precipice, on the south side is continued with the northern end of the Koondahs; yet a spur shoots out from it in a westerly direction, making a segment of a circle, the concavity of which looks north. Along the escarpment of this curve the other two peaks stand in the same manner, and having the same form as the highest one, but of smaller dimensions. The distance between each of these peaks cannot exceed four hundred yards. At the termination of this precipice there is an isolated column-like hill, which raises its lofty summit from among innumerable huge masses, heaped up in the greatest confusion imaginable—the ruins and wreck of its own mass.

The highest peak cannot be more than five hundred feet above the verge of the escarpment; the eastern and south eastern sides have a gibbous configuration, and are perfectly easy of ascent, the horizontal positions of the stratified rock forming it into steps. When half way up we sat down—my companion with his pencil to take a view of the romantic recess of the Koondahs, and I to gaze around me. Fearing giddiness, I did not attempt to walk to the brink of the precipice, but I crawled for the last twenty yards, and when near the Swamy which stands at the very pinnacle of the cone, I sat down; and after a few minutes rest I crept on all fours to the brink, projecting my head only beyond the precipice.

How can pen describe the horrific confusion at the bottom of this awful abyss! Huge masses, portions of mountains I should say, lay scattered, or heaped up, in frightful disorder, at the foot of the parent mountain, which rises, like an enormous column, hiding its lofty summit in the clouds.

I could not gaze at this frightful scene more than two or three minutes; and I retired creeping back to the Swamy, where we enjoyed again the sight of the recess of the Koondahs. We regretted that the clouds, which began rolling along the plains of Malabar, soon deprived us of the pleasure of admiring the mountainous scenery and the plains, at the same time.

After a few minutes we began our descent, and had a few more glimpses of the recess, acccording as the cloudy curtain was, every now and then, withdrawn. We went round the base of the peak to the northern gorge at its foot, and, from this place, the vertical façade of the peak is seen to great advantage. The apex of the cone appears to overhang the base, and the face is rather concave. From this place I could at ease contemplate and admire, without fear of giddiness, the romantic scenery before us.

From this altitude we occasionally looked towards the east at the Cantonment, of which we could distinguish some of the houses, and to our tents, the way to which appeared, from such a height, quite easy and smooth—*facilis descensus*—so that, instead of retracing our steps, we chose to descend the side of the hill (N) a continuation of the peak. Here my labours and fears began ; I never scrambled down precipices so nearly perpendicular to the horizon as I was obliged to do on this occasion.

The three mountains, ascended previous to reaching the peak, are all ormed of hornblende slate, abounding with garnets, of which the whole of the group is formed (No. 163) ; it decomposes into a friable, crumbly substance (No. 164). In the bed of the rivulet, at the foot of the peak, this rock is traversed by a thin basaltic dyke.

At the south gorge the outgoings of the decomposed hornblende slate are seen, assuming the rough scabrous appearance of the lateritic iron ore (No. 165), for which I took it at first, at a little distance. I must repeat here that no where, on the Neelgherries or on the Koondahs, have I seen the rock in such an utter state of decomposition as in this group of Makoortee; sometimes the whole thickness of a huge mass being converted into friable, semi-compact rock, and the greatest number of the blocks being surrounded by many feet of the decomposed rock, still *in situ.*

The whole of the peak is formed of a beautiful schistous diorite, common in many places of the Neelgherries, and abounding with innumerable garnets. The hornblende is highly splendent, black and foliated; the felspar rather scanty (No. 166). Sometimes the hornblende is in a prismatic form, and arranged perpendicularly to the seams; in the specimens I shall forward, the stratification is very evident.

In the middle of the declivity of the peak I saw hardly any basaltic dykes worth mentioning; none at the summit, and an insignificant one at its foot (No. 167). Is it to the absence of intruding rocks that the strata of the hornblende slate owe their horizontal position? Many of them are composed of pure hornblende (No. 168).

The rocks in the northern gorge at the foot of the peak, were decomposed as in the southern, but more extensively (No. 169). Having

seen and examined all we wanted, we began our descent. In a deep ravine which descends from the top of the hill to the right of Makoortee peak, through which a large torrent runs, there are three beautiful cascades, one some hundred yards below the other, which precipitate their waters over the ledges of the hornblende slate. At all these places the horizontal stratification of the rock is more clearly seen than any where else in this group (No. 170); it contains fewer garnets than that of the peak, and some strata are formed of hornblende only (No. 171).

We at last reached the foot of this hill where the perforations, before alluded to, are found; an interesting geological phenomenon, which I hope will throw light in the explanation of similar appearances in some parts of Europe, regarding the origin of which geologists still disagree. I will describe those of Makoortee first, and then mention the analogous ones found in Europe, but at present in a different position from those of Makoortee.

At the foot of this hill is a river, or rather torrent, having its origin in the declivity of the same hill, three or four miles above the erosions we are going to describe, and, after a short course, discharging its waters into the principal branch of the Pykara river. Along the upper part of its course (which does not exceed five miles) its bed abounds with large slabs of hornblende slate, sometimes inclined, over which the water forms cascades; at other times they are nearly horizontal. About a hundred yards north of the place where our tents were pitched, there is an oblong mass of the latter description, sixty feet long and thirty-six feet broad. The rock contains hardly any garnets, and the two usual minerals differ in their proportional quantities in different strata (No. 172). The direction of the strata is E. N. E. and W. S. W., and here, as in other localities, it imbeds nests, or oblong pieces, of granular hornblende, with a few grains of felspar (No. 173), which being more liable to decomposition than the rock containing them, like mica in gneiss, and hornblende porphyry in sienitic granite, fall out, leaving cavities, on the exposed surface of the rock, proportionate to the size of the nest.

Looking at the surface of this slab, which has one or two fissures at an angle with its length, being rather the enlarged seams of the rock than splits, we observe that it is perforated by seventeen cavities, of different dimensions and shapes; their general form, however, is circular, or nearly so, most of them containing numerous rounded small blocks, pebbles and sand. Some of these cavities are situated in the middle of the torrent, others at its sides; their shape and relative situations, are represented in the diagram (Pl. 7, fig. 5). Some are convex, the internal circumference being wider than that at the aperture, somewhat like a *chatty*. At the time I first visited these

erosions (April 27, 1836), and again two months afterwards, the pebbles were all at rest; but, during the monsoon, the impetus of the torrent must put them all in motion by its rapidity and volume, particularly those in the middle within influence of the impetuosity of the waters, making them whirl round violently; and so, by constant and violent attrition, the cavity must enlarge and the masses themselves get rounded and smaller; the possibility of their getting out diminishing, as the depth of the cavity increases. If by chance a slight depression existed on the surface of the rock, and the running water, either from impediments in its course, or from its comparative rest on passing over these nearly horizontal masses, should form a whirlpool, and if this should happen to be above the little depression, where sand and pebbles may have accumulated, these must be put into whirling motion, and begin the work of erosion.

Nearly all the pebbles and masses in these cavities are rounded, some being of an oval shape; their weight varies from hundreds of pounds to a few ounces. Now, the very large masses could not possibly have been rounded by rolling down so short a distance as three miles and a half, from the source of the river; and, although we see some of these large, rounded and polished masses, in its bed, both above and below this spot, we shall shew hereafter, that these cavities are found higher up and lower down likewise; and there is nothing improbable in supposing that the volume and the impetus of the stream may be such at times, as to force some of these stones out of the perforations, and leave them in some corner of the bed of the river. I do not mean to contend that, after rolling many miles, the angular masses become rounded; but what I maintain is (and it is the opinion of all those who have seen such erosions in India), that they are formed by the long continued tossing of the rounded blocks within them; and that these last did not by accident fall in, ready rounded by long rolling from a great distance; and that they are the original cause of these cavities, and produce their increment.

The above explanation supposes a certain cavity to exist, ready made, on the surface of the rock, and then the rest of the process is easily understood; but the question is, what produces those cavities in the first instance. The answer is easy enough—they are the holes left by the nests and oblong pieces of granular hornblende, which are found abundantly in the rock. We know that if cavities exist at the bottom of pools, with comparatively smooth water, through which an impetuous torrent rolls its waters, whirlpools are formed. But in the incipient state of the cavity, the fall of the water on them is sufficient to set the pebbles in agitation. From what we have detailed, we may safely assert that these cavities are formed and increased by the attrition of these rounded stones, which act with more violence on the sides

than on the upper part of the cavities, and produce the concave form which they assume.

It remains now to show, by an example, that this is actually the process, which Nature pursues in the formation of these excavations ; and I was fortunate enough to find it in the same slab. A couple of feet above the upper extremity of the slab having the seventeen cavities, there are two tabular masses overlaying one another. The lower one is the broadest, and is under water, the upper has narrower dimensions, and is above water. Near the edge of the latter, there is a circular perforation (see diagram of the cavities No. 1), two inches in diameter, and three in depth ; it contained sand and a few small rounded pebbles. Opposite to this, and on the surface of the lower stratum, there is another of an oval shape (No. 2) having portion of a nest of granular hornblende (No. 174) adhering still to the cavity by its side and under part, the other portion having been removed. The side of the cavity thus empty, is beginning to get concave and smooth—in short, is in an incipient state ; the surface of the remaining piece of the nest, which is about an inch below the brim, is polished.

I hope that the foregoing facts and observations are satisfactorily conclusive, regarding what I wished to prove. My friend Mr. Viveash, seeing that I was so much interested about this phenomenon, kindly offered to add more information on the subject, which he said was no rare occurrence in India. In consequence of which, he has communicated to me the following : " About thirty miles from Bellary the river " Tumboodra flows, and, at that place, it is dammed in its course to " bring the waters to a high level, for the purpose of irrigation. Many " of these annicuts, or dykes, across the river, are hundreds of feet " thick, and formed with immense masses of granite. A little above " the island of Dashamoor, in the same river is one of these annicuts ; " many of the granitic masses are perforated precisely in the same " manner as those of Makoortee, but considerably larger and deeper, " so as to have afforded me a good bathing place. I am confident these " excavations could not have existed in the masses when brought for " the annicut from a place W. of Dashamoor.

" The annicut west of the island of Dashamoor, is situated at the " village of Kenchengode, about one march west of Dashamoor. The " larger holes are at the most northerly part of the annicut. I have " been in one fully four or five feet deep, and three feet in diameter. " These holes are, I think, in all the old annicuts of the Tumboodra " which I have seen, and I have met with them in annicuts made of " brick-work also. They could not have existed in the stone, before it " was brought to the annicut ; because they are formed in the *masses* of " granite, which compose the annicut, cutting four or five of the stones " which are contiguous (Pl. 7, fig. 6). Besides it is not likely, that

" the workmen would use imperfect stones in works requiring weight " and strength. The larger annicuts are from twelve to fifteen " paces across, with ample room for abundance of perforations of this " kind. If I recollect right, the people of the annicut told me, that the " excavations or holes were occasioned by the working of the stones " detained within them."*

Before concluding the description of these cavities in India, I must be permitted to detail the position, form, &c. of one or two of them, as they correspond so precisely with those described by authors as found in Europe. The largest of the cavities of Makoortee is a treble one, that is, composed of three nearly in a line, their respective levels decreasing. They had evidently been separate, until, increasing in size, they joined into one, the thin lip of separation having been worn out (diagram, Nos. 9, 10, 11). The depth of this triple perforation is three feet, and the length of the three together more than eight feet. Specimen No. 175 is a pebble from this cavity ; one or two in the middle perforation must have weighed more than a hundred pounds. Ascending the river about three hundred yards, there is another slab, larger than the one just mentioned, nearly in an horizontal situation, on the surface of which I counted eight excavations ; none however of the same magnitude as those lower down. They were sufficiently characteristic to show their origin. About fifty yards higher, in another horizontally placed mass, I remarked a double perforation, that is, two joined into one. In the bed of the main branch of the Pykara river about a mile below the place where the tents are usually pitched, is another nearly horizontal mass, with seven cavities on a rather smaller scale, one of which is double, the largest not exceeding ten inches in diameter, and the smaller hardly three inches ; the remaining five were all in a forming state. In this spot, I observed a flat block, on the edge of which was a pretty large perforation, one side being wanting, owing to having been worn out to the bottom, probably from the same causes that produced the erosion of the brims of the double and treble cavities. I am particular in noticing this last perforation and its form, since it appears to me to be perfectly analogous to that described by De la Beche, which I shall have occasion to advert to hereafter. Captain MacLean, who was with us at Makoortee and saw the erosions which we have described, informs me that some weeks after, while riding with the Right Honourable the Governor, along the banks of the Pykara river, about

* All this is sufficient evidence to prove that there is even no occasion for the little cavity, which I supposed might have been left by the decomposed nest of hornblende ; but a small depression in the rock, a seam, a fissure, or in the case alluded to in the diagram, the junctures of different rocks, although contiguous, may be sufficient to give cause and commencement to the erosions, and the existence of the same cavities in annicuts, made of bricks, confirms more and more what we have stated.

three miles below the present ford, in the new Neddiwattum road, they saw a ledge of rocks, nearly horizontal, extending the whole breadth of the river, on which they observed the same kind of perforations as those of Makoortee. I went to examine this locality, and I found them, although not of the same magnitude, yet large enough to show their similarity of origin.

Returning from Makoortee to Ootacamund, the stratification of the hornblende slate is clearly seen in all the hills, more than half the way, their direction being nearly N. E. and S. W. At a ford of the Pykara, the fourth from the tents, it is worth stopping for a few minutes to look at the well defined prisms of columnar clay, which form the right bank of the river, being about ten feet high. These columns stand erect and apart from each other, having a little space between them through which we see a second line of them, peeping in the intervals. More than half a mile of the bank is thus formed.

It is time, now, to treat of the comparison between the Makoortee cavities, and those I have seen, and read of as existing, in Europe, at present raised hundreds and thousands of feet above the influence of those causes which we have seen to operate at Makoortee, and which, as I said, have baffled the ingenuity of many geologists, who have attempted to explain their origin. I shall first describe those found in England, called by the name of *rock basins.*

Dr. Borlase was of opinion, that the so called logging stones are of Druidical origin, representing Saturn, &c., and that what he calls *rock basins* were the pools for lustration, appertaining to that worship. But Dr. MacCulloch, having proved the logging stones, or tors, to be a natural, and not an artificial, production, speaking then of the *rock basins,* says : " these excavations which assume some *curved figure* " *with rounded bottoms,* are produced by the decomposition of the " granite, naturally ; since, if a *drop* of *water* can make an *effectual* " *lodgment* on the surface of the granite, a small cavity is, sooner or " later, produced, and so increasing forms those pools."* This explanation is an example of those eccentric notions, which Dr. MacCulloch occasionally entertained, and defended with childish pertinacity ; like as, in the latter years of his life, he held and maintained that geology, during the last thirty years, has made no advance, notwithstanding the high character of the discoveries in organic remains.

I do not recollect where, but I have read a rather scurrilous refutation of this notion of the decomposition of granite resulting from an " *effectual lodgment of a drop of water.*" De la Beche, in his Geological Manual, after speaking of the influence of electricity and of oxygen in the decomposition of rocks, adds the following passage, which I

* Transactions of the Geological Society of London 1814, Vol. II p. 67.

must transcribe entire, as I think the perforations he describes perfectly analogous to those of Makoortee.

"At Peninis Point, St. Mary's, Scilly Islands, there is a curious "example of that decomposition of granite, which antiquaries have "termed *rock-basins*, and considered the work of the Druids. The "Kettle and Pans, as these depressions are there named, occur in "the large blocks of granite on the top of this promontory; they are "generally three feet in diameter, and about two feet deep and mostly "*circular* and *concave*, but there are others much *indented at the sides*. "'Some have perpendicular sides and flat bottoms; some are of an oval "form, and others of no regular figure. Many of the blocks are six or "seven yards high and eight or nine yards square, and several of them "have four, five, six or more of these cavities in them. A large rock "at the extremity of this group, has two basins of an immense size, "besides several smaller ones. The upper and larger one appears to "have been formed by the junction *of three or more large basins.* It "is irregularly shaped and about eighteen feet in circumference, and "six feet deep. When the water in this basin has attained the height "of three feet, it discharges itself *by a lip into a lower basin*, more "regularly formed, the back of which is about five feet high, but "which is incapable of containing more than a depth of two feet of "water, owing to the declivity of the surface of the rock.'* As a "proof that similar decomposition sometimes takes place on *the sides of* "*a block*, the author, above cited, mentions an oval cavity, six feet long, "five wide, and near four feet deep, thus situated."†

I have purposely marked in italics all the words that precisely correspond with the description of the cavities of Makoortee. I am not acquainted with the opinion of Mr. Woodley regarding these cavities, but that of De la Beche is that they are produced by the *decomposition of the rock.*

After what has been detailed, I think that the conclusion is unavoidable, that the origin of the so called *rock basins* in England must have been analogous to that of the Makoortee erosions; and that, at a subsequent period, by one of those catastrophes which our planet has been subjected to, these perforations, together with the hills or low-lands, in which they had been excavated, were heaved up to the altitude at which they are found at present. If, by a similar catastrophe, the present Makoortee group, should be heaved up some more thousands of feet, the Makoortee cavities would become precisely *rock basins.* I see no difficulty in supposing the nests of mica of the granite (if it be the common

* Revd. G. Woodley; View of the present State of the Scilly Islands, 1822.

† Geological Manual, p. 46, 3d Edition.

granite) of England, to have fallen out in the same manner as those of hornblende in the rock of Makoortee.

Let me now mention two or three localities in the south of Europe, which I have visited, where the rock, although different in nature, presents cavities similar to those of England and Makoortee.

The magnesian limestone of Greece, and of many of the Grecian islands, has, in more than one locality I have seen, the same kind of erosions as we have described; they are of large size, many feet in circumference, of a circular form, smooth as if polished, some of them being situated at the edge of rocks, like indentations.

These appearances I have witnessed in many of the mountains of Epirus; but most clearly in that of the Pandocratera, the highest in Corfu (the principal of the Ionian Islands), being entirely analogous to those in the mountains of Greece. I have also seen the same phenomenon in the Zechstein, near Palermo (Sicily), and on the very summit of Monte Pellegrino. Speaking of this last locality, I do not mean the small perforations mentioned by Daubeny, Christie, Hoffman and Lyell, as found in all the mountains, which, like amphitheatres, rise behind the rich and lovely plain of that capital, and which evidently have been produced by perforating marine animals (Lithodomi). What I allude to are large, smooth cavities, some of them many feet in circumference, resembling, when not in the side of the rock, large mortars. They appeared to me perfectly similar to some of those of Makoortee, and, I am convinced they were produced by the same process.

The above described are the rocks I had an opportunity of examining on the Neelgherries, having met none of the secondary, and much less of the tertiary class. It would appear from this, that the elevation of this plateau, and probably of the whole chain of the western ghauts of which the Neelgherries are the southern termination, happened at a period long anterior to the existence of life on our planet.

It is for this reason that I think Humboldt's opinion not supported by facts, when he says, "the chain of the Ural, the Baloor tâg, the ghauts of the Malabar Coast, and the Vringckan are probably more modern than the Chains of the Himalaya, and the Teenckan"*. We know, that in the Himalaya, at several thousand feet elevation, and on the declivities of the highest ridges themselves, organic remains have been found in limestone, which seems of the age of the carboniferous group.

The nummulitic limestone of Chira Punjì, and the conglomerate rock, which forms the Dehra Dún at the foot of the Himàlaya, appear to assi-

* Edinburgh Philosophical Journal, October to January, 1832. Humboldt on the Mountain Chains—Volcanoes of Central Asia.

milate those mountains to the Alps*. Therefore the Himalaya must have been heaved up at a period posterior to that when the Western ghauts were elevated : these last containing not a trace of organic remains in the rocks which form them, while the former abound in them.

Elie de Beaumont admits the greater antiquity of the Malabar ghauts over the Himalaya chain ; but he conjectures, by the direction of the ghauts being parallel to the Pyreneo-Appenin system, that they may probably belong to his sixth revolution of the surface of the globe. The passage, in which he expresses this perplexity, is worth transcribing, to show of what importance it is to establish the association, and the geological position of the laterite.

" Vouloir suivre ce système jusque dans l' Inde paratrait peut-être abuser de la faculté des rapprochemens : cependant je crois devoir fair remarquer que la chaine des gâtes sur la côte du Malabar semble se cohordonner à la direction, dont je m' occupe. La grand faille, à laquelle parait dû l'escarpement occidental des gâtes, en élevant le plateau du pays des Maharattes, du Deccan, du Carnatic a élevé du même tems, le grand depôt argille-ferrugineux de laterite, qui forme les points plus élévés de ce plateau, ainsi que le montre la coupe des gâtes donnée par M. Christie. Il est à regretter que ce depôt de laterite, qui couvre dans l' Inde de si vastes étendues, n'aie, jusqu'a present, offert aucun fossile, et ne puisse être rapporté avec certitude á aucun étage geologique déterminé : mais on peut toujours remarquer que tant qu'on n' aura pas indiqué d' autre chaine† qui produisse sur la laterite l'effet mentionné cidessus, tout conduit à voir dans les gâtes la chaine la plus récente de la presqu'île occidentale de l' Inde, dont elle est en meme tems le trait geometrique le plus prononcé !"

Then he says in a note, that the Himálaya are more recent than the ghauts, and the Andes more recent than the Allaghanys of America.

We see, by what Beaumont says, that he suspects the laterite to be the equivalent of those rocks deposited during the period that intervened between the deposition of the chalk, and the tertiary beds. But fossil remains being the only sure guide in determining the ages of these formations, and none hitherto having been found in the laterite, the question must still remain *sub judice*. Besides, we must remark here,

* A writer in the Bulletin des Sciences Naturelles, concludes that the Dehra Dun is analogous in formation to the Molasse of the Alps ; and Dr. Falconer is of the same opinion.—De la Beche, *Geological Manual.*

† " With regard to this part of this passage, to show that there are other chains, having different direction from the Malabar ghauts, on the summits of which we see the laterite as an overlaying rock, we may quote some of the branches of the Vindiya range, where the laterite overlays either basalt or sandstone ; and also many sandstone hills on the Northern Circars : and yet the Vindiya chain has a different direction from the Malabar ghauts.

en passant, that the rocks of that epoch in Europe are all stratified, which is not the case with the laterite.

Before concluding this sketch of the geology of the Neelgherries, we must not pass unnoticed the fact of the absence of all sorts of calcarious formation. Even the widely spread kankar is not met with on the Neelgherries, although we find this travertinic deposit at the very foot of those hills, near Mateepolliam (No. 176).

The total absence of stratified rocks, and of calcarious formations, in this group, seems an additional proof of the remote period of its elevation. The only stratified rock, which appears to have been deposited near the place, through which this plateau was heaved up, is the hornblende slate, which is seen both on the east and on the west sides of the hills, being highly inclined, and having an opposite dip : the group serving as the centre of this anticlinal line.

On looking at the map, we see how the numerous valleys and ravines have a different, and often an opposite, direction. Except three or four of them, which diverge in opposite directions from a central point (Doodabetta), the others are so irregular, that it is impossible to refer them to one and the same cause. They certainly do not belong to the class of valleys of denudation, much less to that of corrosion by the streams : the volume of their waters being so very insignificant and divested of pebbly or sandy detritus, which so much hastens the corrosion of the rock through which the rivers pass. They probably are the original consequence of the elevating force, which either irregularly applied to the different points of the area, or the mass itself yielding irregularly in different situations, gave rise to the inequality of the whole surface of these hills.

To conclude, therefore, it seems that the granitic rocks, which occupy the highest hills of this group, forced their way, and were heaved up through the hornblende slate, which was in consequence distorted and lifted up, as it is seen in the outskirts of the plateau, and in some of the low situations among the hills themselves, (the valley S. and close to Kotagherry) ; we must also conclude, that the decomposition of the rock forming the red earth and the detritus, must have happened at a period anterior to the existence of organic bodies ; no remains of which have hitherto been found in them.

II.—*On the Tree which produces the Gamboge of Commerce.*—*By* R. Wight, Esq. M. D.

I am induced to request a place in the Madras Journal for the insertion of a few remarks on the tree which produces the gamboge of commerce, in consequence of the following observations on it, by Dr. Graham, Professor of Botany in Edinburgh, communicated by him in a letter dated 12th March, 1836:—"In consequence of having received specimens from Mrs. Walker of the tree which in Ceylon yields gamboge, I have been attending to the subject lately, and on Monday last, read some observations to the Royal Society (of Edinburgh) about it. I have been obliged to dissent wholly from Arnott and you, that it is the *Xanthochymus ovalifolius*, and Arnott now agrees with me so far, but he has fallen into at least as great a blunder. It is undoubtedly, as I think, the *Garcinia* (*Mangostana* Gœrt,) *morella* of Desrousseaux and Gœrtner. Arnott now thinks it *Garcinia Zeylanica*, which it cannot be, if Roxburgh describes this with any degree of truth. In fact the *Garcinia morella* which I have said it is, is no *Garcinia*. Murray says the tree is *Stalagmitis Cambogioides*, but his description will not apply to my plant, from which I have a great quantity of excellent Gamboge. I have sent a specimen to Mr. Don to request that he will compare it with the specimens in the Bankean Herbarium, from which Murray's description was taken. If the same, the generic name *Stalagmitis* may yet be retained, and the description only altered. If not the same, it must form the type of a new genus, to which I find *Garcinia elliptica* of Wallich also belongs; it is especially characterized by the stamens, of which I send you a figure."

The point on which Dr. Graham, finds it necessary wholly to dissent from us is thus briefly stated at page 102 of the Prodromus. "There can now be little doubt of this (*Xanthochymus ovalifolius*) being the only plant in Ceylon that yields gamboge fit for the arts, and that consequently the specific name of *Gambogia gutta* Linn. ought to have been applied to this species and not to *Garcinia Cambogia*."

The evidence contained in Dr. Graham's letter seems so completely to invalidate the correctness of our statement, that it might appear useless to attempt any refutation; yet I am not satisfied that he is either wholly right, or that we are wholly wrong. I do not think him right in considering the tree of which he has got specimens, as the only one that produces gamboge fit to be used in the arts, nor do I think it is the one which produces the true Ceylon gamboge. I do not think so, because it has been long and well known, that there are two sorts in use, one from the eastward, Siam, Cambogia, China; and the other from Ceylon: the latter considered inferior to the former. The gamboge, from the tree in question, specimens of which I have seen, is

apparently of the best quality, and much superior to the common Ceylon gamboge, having a fine, rather light, colour and glassy fracture. The true Ceylon gamboge is darker coloured, and mixed with dark brown spots. The Ceylon tree which produces the fine gamboge is rare, as Colonel Walker informs me he has only met with it in one place, and that an old garden near a former Dutch settlement, not far from Negombo. It cannot surely be supposed that a tree so exceedingly rare as this is represented, can be the one which affords all the gamboge produced in that island, still less so when it is borne in mind, that that obtained from it, differs in quality from that usually produced there, and known in commerce under the name of "Ceylon gamboge." From these facts I think we are entitled to conclude, that Dr. Graham has drawn a wide inference from insufficient data, or, in other words, has attempted to form a general rule from a solitary example. I do not, however, wish it to be supposed, that I insist on our statement being held strictly correct, because a degree of uncertainty attaches to the tree or trees from which this substance is procured, that all the efforts of Botanists for the last century, have been unable altogether to remove ; all that I have attempted, or indeed wish to prove is, first—that the facts adduced by Dr. Graham are not sufficient to invalidate our position, that the *Xanthochymus ovalifolius* is the only, *indigenous*, plant in Ceylon that produces Gamboge fit to be used in the arts; though I fear from further enquiries, that we were premature in hazarding so strong a statement; and secondly—that the tree, from which Dr. Graham's specimens were procured, is of exotic origin. I shall now attempt to account for the appearance in the island of that tree which is neither a *Garcinia* nor *Xanthochymus*.

About the beginning of the 17th century, the Dutch first imported Gamboge into Europe from China, and, not long after, they expelled the Portuguese from Ceylon, and formed settlements of their own there, which they retained until near the end of the 18th century. Is it at all unreasonable to suppose, that, in the course of that long period, they should endeavour to procure from their own territories a lucrative article of commerce, in place of having to purchase from others all, of the finer sorts, required for their European trade ? If not, we may readily suppose they imported the plants above referred to, and which have remained unnoticed by the English, until Colonel Walker accidentally discovered them about two years ago, in just such a situation as one might expect to find introduced trees, namely, in a garden close by a Dutch settlement. A most interesting discovery it is, since it seems to prove that they are of exotic origin, that the soil and climate are suitable for its growth and propagation, and leaves room to infer, that it might be introduced with success on the west coast, at least, of

India, the climate of which, corresponds in many respects with that of the south west coast of Ceylon ; and, lastly, because, it, in part at least, sets this long agitated question at rest, by making us acquainted with the probable source of the best gamboge used in the arts.

Botanically considered, this plant presents some points of considerable interest, which may be the means of directing more of the attention of Botanists to the peculiarities of the order to which it belongs, than it has hitherto received.

Dr. Graham shows that his plant is not a *Xanthochymus*, neither is it a *Garcinia*, and, unless there is an error in the description, that it cannot be a *Stalagmitis*, but that it forms a new genus, essentially characterised by its stamens, the filaments of which are united into a single square column, and the anthers one-celled, opening at the apex by a calyptra, or lid, in place of two-celled, bursting longitudinally, as in all the other genera of *guttiferæ ;* characters amply sufficient to separate it from every other genus of the order.

To the conviction expressed that this new genus is undoubtedly Gœrtner's *Mangostana morella*, I can offer no objection, as I am altogether unacquainted with that plant, except through the figure, and because Dr. Graham has not stated the evidence on which he grounds this conclusion, but if it should prove correct, I must acknowledge it goes far to establish the fact of its being a native of Ceylon, and, consequently, that the juice of it, as well as of other trees, may be drawn for gamboge as that of *Garcinia pictorea* Roxb. Another member of this new genus is in Malabar.

Here the question must for the present rest; as it can only be finally decided by reference to authentic specimens of the plant described by the older botanists (who usually paid much attention to useful plants) as the "Arbor Indica *Gummi Guttam* fundens," and which has now been bandied about from species to species, till it seems to have multiplied itself into about half a dozen different trees ; but I trust that Ceylon botanists will now be induced to take up the subject in earnest, and ascertain, by actual inspection and the preservation of specimens, the tree, or trees, for there may be several, from which its gamboge is derived, and further to determine whether the trees, which have given rise to this fresh agitation of the question, are of indigenous or exotic origin.

While writing on the subject, I shall avail myself of the opportunity to offer a few observations on the essential characters of the genera, named in the above remarks, namely *Garcinia, Cambogia, Mangostana, Stalagmitis* and *Xanthochymus ;* with the view of directing attention to some points of structure, which, it appears to me, have not been suffi-

ciently attended to in the construction of these genera, giving rise, in consequence, to much confusion and uncertainty as to the species that ought respectively to belong to them.

In 1737, Linnæus published his genus *Garcinia,* formed from Rumphius' *Mangostana,* assigning as its essential character 16 stamens (*Dodecandria*) and an eight-seeded berry. In 1748, he published, in his Flora Zeylanica, *Cambogia,* assigning to it numerous stamens (Polyandria) and a pomacious, eight-celled and eight-seeded fruit. Pomum 8-loculare, semina (*i. e.* in each cell,) solitaria. In 1789, Professor Murray of Gottingen published his genus *Stalagmitis,* assigning to it a quaternary proportion of sepals and petals, pentadelphous stamens, and a one-celled, three-seeded berry. In 1791, Gœrtner attempted, from an examination of the fruit of three species, to reform the Linnean genera, and, on carpological characters, united *Garcinia* and *Cambogia* under Rumphius' name *Mangostana,* assigning to his new genus, a quaternary proportion of parts, indefinite stamina, and a four to eight-seeded berry. This genus, with the exception of the name, has been adopted by all succeeding writers. In 1798, Roxburgh published his *Xanthochymus* (Cor. Pl.), well distinguished from the former by its quinary proportion of parts; five sepals, five petals, five fascicles of (pentadelphous) stamens and an unequal (three to five) seeded berry. The characters of all these genera, it may be observed, are, with the exception of the last, incomplete, owing to the authors having overlooked their polygamous inflorescence, and neglected to avail themselves of the peculiarities of the male flower; an imperfection not felt, so long as every plant of the order, with a quaternary proportion of organs, was referred to *Garcinia,* but to which, now that a new genus is added, agreeing in that particular, it is necessary to attend: the more so, as some of the species of *Garcinia* approach the new genus by having their stamens united into a head, while others approach *Xanthochymus* by having theirs fascicled and are only to be distinguished by their proportion of parts. It is of great importance to attend to proportion in this tribe, as we are thus enabled to discover what Murray's *Stalagmitis* really is. We have seen that Roxburgh's *Xanthochymus* has a quinary proportion of parts, pentadelphous stamens, and an unequal (3-5) seeded fruit. In *Garcinia* the quaternary proportion prevails with an equal (4-8-12) seeded fruit. In *Stalagmitis* both are said to be combined, an union, which all must acknowledge to be most improbable.* Petals and sepals are deciduous, or may be carelessly examined; not so the fascicles of stamens, they are small, and must be examined carefully if to be seen at all, and the num-

* Since writing the above I find that Roxburgh describes the flowers of *Xanthochymus ovalifolius,* as having occasionally four sepals and four petals, which identifies it with Murray's *Stalagmitis Cambogioides,* the Ceylon Gamboge plant of that author.

ber of seeds are not subject to accidental loss in drying or examining. The quinary proportion of stamens and uneven number of seeds afford I think almost irrefragable proof of the identity of *Stalagmitis* and *Xanthochymus*, the petals and sepals only being erroneously described.

This view is confirmed by Mr. George Don, in his edition of Miller's Dictionary, having reduced Roxburgh's *Xanthochymus* to *Stalagmitis*, I presume on the authority of Murray's own specimens which he could examine in the Bankean Herbarium; an arrangement in which we, not sufficiently adverting to his opportunity of determining the identity of these genera, did not think it safe to follow him. By thus uniting *Garcinia* to *Cambogia*, and *Stalagmitis* to *Xanthochymus*, the confused assemblage is reduced to two very distinct genera. The only question that remains to be considered is, whether or not it is advisable to leave them as they now stand.

In my opinion the genus *Garcinia*, as now constituted, ought not to be retained; a glance at the accompanying figures will explain my reasons for thinking so by exhibiting in one view several of the incongruities which it presents. For example, the *Garcinia mangostana*, (Pl. fig. 2) *speciosa*, (Pl. fig. 1) and *cornea*, have the filaments of the male flower united, forming four large fleshy bodies covered with anthers, and two of the three are known to have a glabose, not sulcated fruit. These might form the type of a genus under Rumphius' original name *Mangostana*. *G. Cambogia*, (Pl. fig. 3) has the stamens of the male flower ranged in a single row, round a disk-like receptacle, with a sulcated fruit. This might form the type of a second genus, for which, as nearly corresponding with the character assigned by Linnæus to his *Garcinia*, that name might be retained. In *G. Kydia*, (Pl. fig. 4) *Zeylanica*, *pedunculata*, *paniculata* and *affinis* (Pl. fig. 5) the filaments are united into a staminal column, terminating in a head covered with anthers, fruit usually furrowed. These might form a third genus, retaining for them the now vacant name of *Cambogia*: and lastly, *G. putoria*, Roxb. (*Mangost. morella* Gært?); *elliptica* Wall. (*fid.* Graham) and Dr. Graham's Ceylon plant, (Pl. fig. 6) would form a fourth, distinguished by their united filaments, and cup-shaped, one-celled, circumscissile, anthers; for which the now vacant name, *Stalagamitis*, might be retained, in preference to disturbing Roxburgh's *Xanthochymus*, now well established, by rigidly enforcing the rule of priority, and restoring that of Murray, thereby causing considerable confusion in the synonymy, that might thus be easily avoided.

Palamcottah, 2*d August*, 1836.

1
G. Speciosa Wall
4
G. Kydia
7
3
G. Camboqia Roxb.
5
G. Affinis
8
2
G. Mangostana Linn.
6
9

BRITISH MUSEUM

III.—*An Account of the Harbour of Tuticoreen.—By* R. WIGHT, Esq. M. D. *with sailing directions for making the Harbour, and a Chart in which Bearings and Soundings are laid down, communicated by Lieut.* JENKINS, *of the* 33*d M. N. I.*

I have much pleasure in sending herewith a Chart of the Harbour of Tuticoreen, in the hope that it will be considered a fit subject to occupy a place in the Madras Journal of Science, though scarcely entitled to the denomination of scientific. When, however, we enlarge our view, and trace the advance of science, from its origin to its present condition, we cannot fail to remark, how much its progress has been influenced by the extension of commerce, and must conclude, that whatever tends to extend the one, must give a forward impulse to the other. But leaving that question out of sight, and viewing the subject with reference to its utility only, it will, I trust, be found worthy of a place in a journal, the main object of which is the improvement of India.

Tuticoreen is the most considerable sea port in the Tinnevelly district, and formerly carried on a large trade, the exports, according to Milburn, amounting to 365,314 Sicca rupees. Of late years it fell off considerably, but within the last two, owing to the extension of the cotton trade, has again assumed an importance, that could not a short time before have been anticipated. No fewer than 3,000 bales of cotton have been, in less than fifteen months, shipped from it for England direct; 3,000 more, intended for the China market, were sent from it to Madras by coasters, to be finally shipped there, while 1,000 were sent by land, from Tinnevelly, for transmission to England. A short explanation of the circumstances which gave rise to the indirect course pursued in these two instances, will explain my reasons for requesting an early publication of this chart.

The excellence as well as the cheapness of Tinnevelly cotton is well known. For these reasons a mercantile house in Bombay sent an agent here last year to make purchases for the China market. He purchased 3,000 bales, and then endeavoured to engage a vessel in Bombay, to convey it from Tuticoreen to China, but could not get one to venture to come there, for want of a good chart and sailing directions; consequently, after losing several months in the vain expectation of finding one, he was at length forced to send the whole to Madras, at a very considerable extra cost. The other, from the same cause, sent his cotton to Madras by land, either from that being the more safe route, or from the season of the year being unfavourable for vessels sailing up the coast.

With respect to situation, Tuticoreen possesses considerable advan-

tages for trade, more especially foreign trade, by affording a convenient opening for the introduction of foreign articles of consumption, as well as an outlet for the exportable productions, especially those intended for England and China, of the Madura and Tinnevelly districts. For the latter purpose, it can be easily reached by vessels from Colombo or the Malabar coast, in the event of their failing to complete their cargoes at either of these places. It has besides a safe roadstead with good anchorage, in which vessels can ride at all seasons of the year, and take in their cargoes during the prevalence of the north east monsoon. This is an important advantage, as coasters might then be employed to bring goods from the more northerly districts for exportation, and thereby save the time, now lost, in waiting for southerly winds to carry them to Madras, an arrangement which will benefit, both the coasting trade, and the merchants wishing a speedy despatch for their goods. Presenting so many and inviting prospects of success, it appears in every way desirable, that the approaches to it, both by sea and land, should be improved to the utmost; with this view, it is more than ever desirable that the recommendation of our Government, for opening a navigable passage at the Paumbaum pass, should be acted upon, and good charts published of the gulph of Mannar; while the roads through this and the Madura districts might be improved, to facilitate the transmission of cotton from those parts of them, where the better sorts are produced, as well as saltpetre, sugar, tobacco, &c. from Coimbatore.

The improvements recommended may indeed be said to have already commenced; a noble bridge is about to be built across the Tamburapoony river at Tinnevelly, and plans are now before Government for the formation of a system of railroads, intended to traverse the country from east to west and north to south: the southern line to intersect two others, the one crossing the peninsula in a nearly straight line from Porto Novo to the Malabar coast, the other connecting the two Presidencies of Madras and Bombay, by way of Bangalore, Bellary, and Poonah. Should it ever be the good fortune of India, which I sincerely hope it may, to be blessed with such an admirable series of internal communications, by which the most distant provinces of the peninsula, will be brought within the distance of a few days travelling, the importance of Tuticoreen will be greatly increased, as ships either from England direct, or from Malabar, can arrive there, almost without losing a day, at the height of the monsoon, and can ride in five fathoms water with perfect safety, and take in cargo without interruption, in the worst weather almost ever experienced on this part of the coast. We should thus have two leading ports on the east coast, one of them always open, connected on the one side by the sea, on the other by a rapid and at the same time cheap land communi-

cation. At present, we are, generally, during three months of the year, cut off from direct communication with England. Such an imperfect arrangement would not be any longer necessary : on the contrary, as it is estimated that loaded carts would travel on the railroads at the rate of nearly a hundred miles a day, packages for Madras would arrive there by that route, in shorter time than ships could convey them by sea, even supposing there was no risk, either to ships lying in the Madras roads or of interrupted communications with the shore, neither of which is the case during at least two months of the year. To make known, it may be, to some of your readers the existence of such a port, and to others the facility with which it may be reached, at those seasons of the year when all other ports north of Ceylon may be said to be closed, is the principal object of this paper ; for I feel assured, that, in proportion as the advantages it holds out to traders, of getting cargoes of cotton on reasonable terms, become known, it will be more frequented, and may ultimately lead to its becoming the grand emporium for the whole of the exports from the southern provinces, and a medium for the introduction and diffusion of wealth over a wide tract of rich country, possessing within itself vast capabilities for trade, but the resources of which, from its remote situation, and for want of a proper outlet, have not hitherto been drawn forth to the extent that they might and ought to be.

I cannot conclude my part of this paper, without suggesting for further consideration, the propriety of attempting, on this part of the proposed rail road, the use of locomotive steam carriages. I do so, on the supposition that some part of the proposed line of road approaches to within a few miles of the range of mountains which divides the Tinnevelly district from Travancore ; and which are everywhere covered with forests of large timber, as well as with trees of smaller growth. These might be sacrificed, especially the latter, with much advantage to the country, and converted into coke for the engines, at a smaller cost than would be necessary for keeping up so many horses as would be required, in the event of the traffic becoming considerable, of which I think there cannot be a doubt, and would be attended with the additional advantage of clearing, and opening, to the labours of the cultivator, an immense tract of country, which has hitherto been the refuge of wild beasts, and a generator of that most pestilential miasma which produces jungle fever. The valleys of the whole of that range, as well as the slopes of the hills, are covered with a rich vegetable mould, fit for the production of all kinds of plants requiring such a soil, and on which it is known, coffee, nutmegs and cloves thrive exceedingly well ; to which, judging from a few very healthy plants which I saw, I would add cocoa and mangosteens, while for the cultivation of oranges, sub-alpine valleys are of all places the most suitable. To these may be added,

for trial on the cool tops of the hills and interior valleys, potatoes and European vegetables, for ships' crews, as well as for exportation. Such changes as these are not of course to be effected on a sudden, or even in a few years, because the demand must first be established, but there can be no impropriety in showing what may be expected to result, should the demand arise by Tuticoreen becoming a port of considerable resort for European ships, in which case, coffee and potatoes would prove most valuable crops, and might, with perhaps many others, be produced to an unlimited extent.

Palamcottah, 2*d August* 1836.

The accompanying chart and subjoined directions for making the Harbour were communicated by Lieut. Jenkins of the 33d Regiment N. I., who verified all the bearings and soundings himself, and is well assured of their correctness, especially the former, as he had them recently compared by the Captain of the *Peru*, now taking in a cargo of cotton there.

" Vessels bound to Tuticoreen during the N. E. monsoon, will find some difficulty in beating up the gulph, particularly along the Tinnevelly coast, as a strong current (at about five knots an hour) sets round point Manapaud. Captain Bleasdale, in the *Robert Quayle*, bound to the above port in the month of November 1835, from his former experience on the coast, tried whether beating up the Ceylon coast would not be preferable, and found it fully to answer his expectations.

" He, on rounding Cape Comorin, sailed across the gulph, then, hugging the Ceylon coast, beat up till nearly in the parallel of latitude of Tuticoreen, and then stood across.

" In sailing along the Tinnevelly coast, I am given to understand that there is no danger to be apprehended, provided ships do not run under seven fathoms.

" In making the port of Tuticoreen, Horsburgh mentions, I think, that there are some store rooms and houses on the islands. These houses have now no existence, and the only ones to be seen are those in the town of Tuticoreen; except a tower, as a land-mark on one of the islands.

" The best plan, and the one recommended by the pilots of the port, is to beat up till you get two red hills (about fifteen miles off) *in one.* Then stand in, keeping the tower on the island nearly in one with a cotton godown, a conspicuous large building, the southernmost in Tuticoreen, consequently the town will be open to the north of the tower; then anchor in five fathoms, gravel. Tower bearing W. ¾ N., church on Vaunthvoo Island N. ¼ W. palmyra trees on Pandien Island S. W. ½ W.

Salt Pans
Vaunthevoo Isle
Roman Church
Roman Church
TUTOCOREEN
Cotton Godown
Landmark
Hare Island
Gravel
Carpenter's Isle
Palmiras
Pandien Island
Coffin Isle
Further S.W. the water Shoals to 1½ Fathoms
A Chart of TUTOCOREEN
Scale of 2000 Yards to an Inch
Yards

BRITISH MUSEUM
NATURAL HISTORY

"The advantage of this spot is, that boats with cargo can run out from the port in the morning, and return again with a fair wind, as during the months of November, December and January, there is a land wind, to the west of north till after sun-rise, it then gradually veers round and about noon the sea breeze is about due east. There is also good holding ground there, and a ship may ride during the monsoon by a single anchor.

"The accompanying sketch of the harbour is intended merely for the use of small vessels, and to give some idea of the localities of the place.

"The tower on the island is in latitude north 8° 47′ 16″ and longitude, east of Greenwich, 78° 15′ 13″.

"The rise and fall at spring tides, is four feet."

IV.—*A short Account of the Irrigation of the Delta of Tanjore, formed by the Cauvery and Colleroon.*

If the value of this piece of irrigation is judged of by its actual results, it must certainly be considered one of the finest in the world. It is indeed very doubtful whether there is any tract of country artificially irrigated, that can, upon the whole, compete with it, considering its extent, its population, the comfort of the people, the revenue it yields, and the climate. The Delta commences at the head of the island of Seringham, about ten miles west of Trichinopoly. The river which forms it, is, to the westward of this point, generally called the Cauvery, and, when spoken of in contradistinction from that part of it which lies to the eastward, it is called the Agunda Cauvery. Its source is near Mercara, the capital of Coorg; after passing the eastern ghauts, it receives the waters of three large rivers, all on its right bank; namely, the Bhowany, which, with its tributaries drains the greater part of the Neilgherries, the Noel which also rises in those mountains, and the Ambarawatty which rises in the Delly mountains, forming the southern boundary of the district of Coimbatore. It also receives the waters from the Shendamungalum or Coilly Malay and the Pachee Malay (forming the north west boundary of the Trichinopoly district) by the Iyaur, which falls into it exactly opposite the head of Seringham. Its principal feeders thus rising close to the western ghauts, it has the full benefit of the south-west monsoon, and this constitutes it the noblest natural gift that God has bestowed upon the Carnatic, conveying, without the labour of man, a portion of the abundant monsoon of the west coast to a tract of country less favoured with local rains.

The Cauvery is generally perfectly empty in the months of March,

April and part of May; towards the end of the latter month, a litttle water frequently comes down, but not sufficient to supply the irrigated lands and to fill the sands all the way to the sea; about the middle of June the regular fresh, caused by the south-west monsoon, generally reaches Trichinopoly, and by the end of the month the supply of water is usually sufficiently abundant to reach the sea, though this does not always happen before the middle of July. The highest rise of the river, caused by the south-west monsoon, ordinarily takes place in July, and there is a good deal of water in August; in September or October it falls very low; this is called in Tanjore the *peritassee kacheal* or September drought; towards the end of October it begins to rise again from the rains of the north-east monsoon, is at its highest about the middle of November, and falls continually from that time, till about March, when there is frequently no running water at all in the river.

To proceed with the account of the river and its branches.—At the head of Seringham, it divides into two great streams; the northern, which is the main channel, and flows on the lowest level, is called the Colleroon, and the southern retains the name of Cauvery. The Colleroon is about from 900 to 1300 yards broad; it skirts the high ground on the north side of the Delta, all the way to within thirty-five miles of the sea, where the land on its northern side begins to be alluvial, and so may be considered as part of the Delta, though the Colleroon throws off no natural branches, either on that side or to the southward, throughout its course, excepting the small one which separates near the sea and forms the island of Pitcheveraim. At the head of the Colleroon, a high and strong embankment, rivetted with stone, is brought from the high ground on the north side, distant about three quarters of a mile, to the edge of the river, and an embankment is continued from thence along the north side, about twenty miles, to beyond the east end of Seringham, to protect the highly cultivated talook of Laulgoody, which is several feet below the surface of the river in high freshes. This talook is watered by two large and several small channels led off from the Colleroon; the largest is from fifteen to thirty yards broad, and upwards of twenty miles in length. At the eastern end of Seringham, the Colleroon receives the surplus waters of the Cauvery from the grand annicut, which will be afterwards mentioned. From thence to the sea it has an artificial embankment (in some places four yards high), along its south side, to protect the Tanjore lands, which are all low and highly cultivated. On this side the lands are mostly watered by the Cauvery, the Colleroon supplying only one channel of any consequence; this is the Munnyaur, which branches off north-east of Triviar, is twenty to thirty yards broad, and about forty miles long, watering about ten thousand vaylies, or eighty thousand caw-

nies, of land. On the north side the land being generally high, as above stated, to within thirty-five miles of the sea, there are only partial embankments. At that point, two miles east of Kurpoor, the great channel called the Vuddavar branches off; it is about eighteen yards broad at its head, runs fifteen miles, when it flows into the Veeranum tank—the largest artificial piece of water in the Carnatic, and perhaps in the world; its embankment is twelve miles in length, its circumference, when full, twenty-five miles, and it will contain about one hundred million cubic yards of water before it would burst, but is not allowed, ordinarily, to have in it more than about seventy millions. This channel and tank water the talook of Mannargoody in south Arcot; there are about forty sluices, in the whole embankment of twenty-seven miles, including both tank and channel; the lands dependent upon them are about eighteen thousand cawnies, but, through the neglect of these valuable works, they are at present imperfectly supplied with water. These works were constructed by Veerana Shola Rajah, who also built the great Pagoda of Gungaconda, where there was formerly a large city, but now almost the whole country, for many miles, is covered with dense jungle. Below the head of the Vadavar the north side of the Colleroon is embanked to near the sea; in which part of its course it throws off four considerable irrigating channels, which water the talook of Chellumbrum; the principal of these, called Cawn Saib Voikal, is about thirty miles long, passing near the town of Chellumbrum and terminating close to the south bank of the Vellaur, about one and a half mile above Porto Novo. The surplus water in the freshes fall into that river.

The Cauvery and its branches should next be described. The total breadth of the Agunda Cauvery, at the head of Seringam, is just a mile; of which about one thousand one hundred yards is the breadth of the Colleroon, and the remainder that of the Cauvery. Between its head and that of the Vennaur, the Cauvery throws off two channels for the irrigation of Seringham, and two or three considerable ones on the south side, which water part of the Conaud talook of Trichinopoly. The Vennaur leads off from the south bank of the Cauvery about eight miles below Trichinopoly; it is the most important of all its branches, supplying all the southern part of the Delta. It throws off several large natural branches, namely, the Pamaneeyaur, the Corayaur, and the Atheeveeraramanaur, on the south side, and the Vettaur on the north, and its waters are entirely dispersed before it reaches the sea; it terminates in an irrigating channel, about twenty miles south-west of Negapatam. About eight miles from the head of the Vennaur, there is a very ancient work across that river, to raise the surface of the water and throw a portion of it into two large channels, one on the north and one on the south side of the river. This is a very rude work, and has long been in a

dangerous state, but it has lately been strengthened. About three miles below the head of the Vennaur is the weir, called the grand annicut; upon this important work by far the greater part of Tanjore depends for its supply of water. Formerly, the whole of the waters of the Cauvery, in low freshes, probably fell into the Colleroon, or at least a great portion of them: the annicut prevents any of the water rejoining the Colleroon, till there is more than the irrigation requires. It is three hundred and sixty yards long, and seven feet above the bed of the river, built of rough blocks of granite, and mud inside, and of stones and chunam on the outside; the breadth varies from thirty to sixty feet; the quantity of stone used in its construction is enormous, and it is in appearance a very rude work, but time has shewn that it is quite secure, having withstood the most severe freshes uninjured. It was formerly higher at one end than at the other, but the lower part was raised by Colonel Caldwell about thirty years ago, and a row of stones about one and a half feet high, placed at intervals of five feet all along its crest; against these stones planks are placed, by which the water is raised about one foot above the work when requisite, the planks being removed when the water raises above that level; when the water is as high as the top of the planks, all Tanjore is abundantly supplied. In the high fresh of 1819, the water rose to the height of eight feet above the annicut, notwithstanding that this stream, eight feet deep and three hundred and sixty yards broad, with a very great velocity, returned into the Colleroon, so much water remained in the Cauvery that there were about three hundred branches in the artificial embankments of the rivers in Tanjore, and almost every part of the district was so completely submerged, that for three days, there was scarcely any communication between the different villages. It may here be mentioned that in the large mound of earth on which the west wing-wall of the annicut rests, there is probably the most magnificent Peepul tree in the Carnatic; it divides, just above the ground, into five or six main limbs, each of them of the size of a large tree. Below the grand annicut the Cauvery throws off the Codamoortee from its south bank, about eleven miles above Triviyaur; below this point the Cauvery, Codamoortee, Vettaur and Vennaur, are rivers of nearly the same size; the Codamoortee throws off the Arselaur, a large river, from its north bank, and the Arselaur throws off the Trimulrajen from its south bank; in this manner the various branches divide and subdivide. At Combaconum there is a noble bridge over the Cauvery, built by Captain Faber; it has five very flat elliptical arches, the centre one of forty-five feet span; it is built entirely of brick, and is the only work of civil engineering throughout the Carnatic (excepting at Madras), that would remind a traveller that he was in a country governed by an educated people. A similar work planned by the same officer is now nearly completed; it is

built over the Vennaur near Tanjore, at the expence of His Highness the Rajah, who deserves great credit for so useful an application of money. After passing Combaconum the Cauvery throws off the Verasholen from its south bank. At Myaverum its breadth has diminished. Here a private native gentleman is now constructing a bridge. Before it reaches the sea it is only three or four yards broad, and it is only in very good freshes that any water ever enters the sea by it. No rivers lead off from the north side of the Cauvery; but innumerable irrigating channels, of all dimensions, flow from it, as well as from every other river in the district; almost every one being provided with a sluice at the head, which is shut when there is too much water in the river.

All the various rivers are also embanked on both sides, with the exception only of one or two places, where several rivers approaching very near to each other, no banks have been constructed, and in very high freshes the water there spreads all over the intermediate lands. The total length of embankment in the Delta is not easily estimated, but it can scarcely be less than two thousand miles varying from one to six yards in height. There are five large works on the Cauvery, which have not yet been mentioned; one of these is a Calingulah, or work for the discharge of surplus water; it is situated on the island of Seringham about four miles from its head, and forms an opening in the north bank of the Cauvery; it is one hundred and fifty yards in length, and is intended to allow a large body of water to flow back from the Cauvery into the Colleroon in very high freshes, where the south embankment of the Cauvery near Trichinopoly, and all parts of the embankments in Tanjore are always much endangered, and have been frequently breached. The other four works alluded to above, are what are called under-sluices. The Cauvery and many of its principal branches having no clear outlet to the sea, the sands brought down from the westward are of necessity deposited in the beds of the rivers and of the irrigating channels; from the latter it was cleared out annually by manual labour, and in the former much labour was constantly expended in cutting channels through particular accumulations, but of course no permanent effect could be produced on a river of this size by such means; the bed of the rivers thus gradually rose, to the great danger of the neighbouring lands and villages; for where a breach took place all the cultivation in its neighbourhood was buried several feet deep in sand. Formerly it appears that after this evil had arrived at a certain height, it corrected itself, in some measure, by the river making a complete breach and going bodily into a neighbouring branch, which, from having a clear outlet to the sea, flowed on a lower level, and into which very large quantities of sand were thus discharged. This was the case some years ago with the Cauvery,

which broke its north bank a little below Triviar and went bodily into the Colleroon, covering many thousand cawnies of valuable land with sand, and leaving all its eastern cultivation entirely without water. The loss, both to the land owners and to Government, caused by such accidents, was of course very great, and to prevent them, the embankments were everywhere strengthened and raised. Breaches have since therefore been less frequent, and the bed of the Cauvery continued to rise till for several years it had been a constant cause of alarm. The under-sluices were first suggested by Major Sim as a safe remedy for this evil, and the construction of them was commenced by Captain Faber in 1830; they appear to have answered their purpose, for nothing is now heard on the subject of the sands. These works are of masonry with several vents lined with granite, and placed in as low a level as possible, so as to be much below the general level of the sands in the river; a channel leads from them to the Colleroon, and as the Cauvery flows on a level of from one to twelve feet above that of the Colleroon, the water passes through the sluices with great velocity, and carries off the sand in very large quantities. They are only opened when there is more water in the river than is required for the cultivation. The first of these works is situated about two miles below the head of Seringham; it has tweuty sluices and is calculated to discharge from 500,000 to one million cubic yards of water per hour. The second set of ten vents is in the body of the grand annicut; the third about four miles west of Triviar, and the fourth about ten miles east of that town. Of these, however, only two sets have yet been used to any considerable extent, the others having been more recently completed. Another set of works have also been constructed of late years to assist in regulating the distribution of the water through the district. The heads of the different branch rivers undergo continual changes, unless constantly watched; but even a single fresh often much widens or deepens the head of a branch, or throws up sand across it, so as materially to alter the proportion of water which it receives; in this manner, notwithstanding great attention, a river frequently gets much less or much more than the proportion of water due to its extent of cultivation; as a partial remedy for this, and one which could be applied on the instant, three channels were cut, connecting each two of the principal rivers, and furnished with sluices at their heads, by means of which a portion of water could be let off from the one river to the other when it was necessary. Two new annicuts have also been just constructed across the Colleroon, one at its head, that is, at the head of Seringham; this work is about eight hundred yards long, and is intended to turn a larger body of water into Tanjore during the low freshes. Hitherto the division of the waters of the Agunda Cauvery has only been regulated so far as could be accomplished by attending to the state of the head

of Seringham, and it seldom divided more favourably in the low freshes, than for one half to flow down the Cauvery, and one half down the Colleroon, while the cultivation under the former is about six times the extent of that under the latter river. Thus it constantly happened that while the Cauvery had one fourth of a proper supply of water, the Colleroon had much more than it required; and often a much greater quantity was flowing to waste to the sea by the Colleroon, than would have been sufficient to complete the supply of water to Tanjore, and this at a time when many thousand vaylies of paddy were perishing for want of it. By means of this annicut and the sluices above mentioned, the water, in moderate and low freshes, can be divided in such proportions as the principal Collector may require. There are many sluices in the body of the annicut by which the sand can be let off, and by which also the distribution of the water can be partly regulated. This work consists of three parts, into which it is divided by two islands in the river.* The other new annicut is situated at the head of the Vaddavaur above mentioned, which waters the talook of Mannargoody in South Arcot. It is intended to give that talook, and also the talook of Chellumbrum, a more constant supply of water; it is also proposed to cut a channel from the south end, to convey an additional supply of water to the north-east talooks of Tanjore; by thus obtaining a complete control of the water in the lower part of the Colleroon, no more need be allowed to pass the head of Seringham, than is absolutely required for the cultivation under the last mentioned river, and hence, in the low freshes, the water will all be distributed to the cultivation, and, in a good measure, divided in the proper proportions. Canal sea end,

The number of works of different kinds constructed in the Delta for controlling and distributing the water, is roughly estimated as follows:

Large annicuts or wiers	4	
Smaller do.	6	
Sets of under-sluices	5	
Large calingulahs	4	
Other smaller works of masonry, namely head sluices, surplus sluices, aqueducts, small under sluices, annicuts and calingulahs bridges, tunnels, by judgment, probably	10,000	
Embankments to the rivers upwards of	2,000	miles.
Roads raised from 2 to 8 feet above the paddy field	200	do.
Irrigating and surplus channels probably not less than	20,000	do.

* The northern division of this annicut has since been breached during a fresh in the river, but it can be repaired without difficulty; the two other divisions remaining uninjured, a very great additional quantity of water has been thrown into Tanjore, and the effects have been very important.

The total extent of irrigated lands in the Delta is about 100,000 vaylies, or 500,000 cawnies, of which about 16,000 vaylies, or 80,000 cawnies, are *maniem,* or tax free lands. The remainder may be estimated to yield a revenue to Government of thirty-six lacs of rupees per annum, but it of course varies in some degree with the supply of water. The total population of the Delta may be roughly stated at one million; the total revenue at fifty lacs of rupees, and the surface at 2,500 square miles; thus there are about 400 inhabitants to the square mile, and they pay to Government about 5 Rupees a head per annum. The average produce of a vaylie may be stated at 160 cullums, each containing 24 seers, and valued at half a rupee, making the total quantity of paddy grown about 170 lacs of cullums, and the value of the gross produce 85 lacs of rupees. The revenue paid from this, that is, from the irrigated lands only, is about 35 lacs.

It is evident that the production of this quantity of grain, and consequently the revenue and the comfort of the people, are mainly dependent upon the supply of water, and hence the great importace of the irrigation works being carefully attended to. The total quantity of water required for the irrigated lands, at that season when they require the largest supply, that is for some time after the main crop is transplanted, is about 2,200,000 cubic yards per hour; but, towards the latter part of the season, when the ground is well shaded by the crop, the land thoroughly saturated with water, and the weather cool, one fourth of a full supply is probably sufficient, and for the last month before cutting, no new water is required. The extreme time occupied in cultivating the irrigated crops is from the 15th May to the 15th March, or about 300 days, but of this time there is only a small quantity of water required for 60 days, leaving 240 days on which a considerable supply of water is wanted; and, of this time, only about 150 days is occupied in the cultivation of the main crop. During the other 90 days the early or ear crop is cultivated; this crop is cultivated in about 30,000 vaylies; about 15,000 vaylies bear two crops. The greatest quantity of water required on any day may thus be estimated at 50 million cubic yards, and the average quantity for 250 days, at 26 millions per day, or 6,500 millions for the whole season. The average quantity that entered the Delta the last 20 years, in a moderately good year, *rejecting what was superabundant on each day,* was about 6,500 millions, or the total quantity required; but then this supply is irregular, and, though the total quantity should be nearly sufficient, yet if it happens, as it does almost every year, that for some part of the season the supply is very deficient, and if, as is usually the case, the distribution is far from perfect, a great extent of crop will be injured; thus the actual amount of produce, is always much below what it might be, even on the lands now irrigated, and there is much land fit for paddy, for which there has not

hitherto been sufficient water. It will be easily perceived, that, though almost the whole season is favourable, a short supply for a fortnight may so seriously check the growth of the crop, as materially to affect the produce, and this is very especially the case if it happens, as it frequently does, about the beginning of January, when a great extent of crop is in flower; if there is any deficiency in the supply of water at the time the flowers are going off, the produce is sure to be little else than husk. It is estimated that the actual produce is below what it would be, if the supply of water was ample, by about twelve lacs of cullums, of the value of six lacs of rupees.

The new annicuts, it has been calculated, will place an additional supply of about 3,000 million cubic yards at the disposal of the revenue officers, on those days *on which there would, without them, have been an inadequate supply*, and not calculating what would be superabundant on any day. Thus, supposing that, on a certain day, there passed down the Agunda Cauvery 50 million cubic yards before the annicut was built, about 25 million would go to Tanjore, leaving a deficiency of 25 millions in that district, and the other 25 millions would flow down the Colleroon; of this about seven millions would be required for its cultivation, and the remaining eighteen millions would flow to waste into the sea. By the assistance of the new annicuts it is expected that the whole of this water would be properly distributed and usefully applied, namely forty-three milllions to Tanjore, leaving a deficiency of only 7 instead of 28 millions; and 7 to the lands irrigated by the Colleroon; and in this way it is calculated the whole of the cultivation may be supplied fully for about 200 days, without a single day's intermission, namely, from the 15th June to the 5th January. In such years as the supply of water in the AgundaCauvery is not much below the average, but in a moderately good year, there is reason to hope that the supply would always be more than sufficient for the present cultivation, and supply a very considerable extent of land at present waste or cultivated with dry grains.

With respect to the comfort of the people in the Delta generally, and the healthiness of the climate, probably most persons who travel through its villages would consider the great body of the people as well fed and as healthy as those of any part of India. In climate indeed it is a remarkable contrast to many tracts of watered land, being entirely free from miasma. In temperature it is much the same as the other districts of the Carnatic, till the rivers begin to fill in June, from which time the heat is considerably diminished.

In the above account of revenue it is calculated that each individual pays to Government five rupees per annum; equivalent to ten shillings. In Great Britain and Ireland a population of 22 millions

pay about 42 millions of pounds sterling or 40 shillings a head ; and as the price of bread corn is there about six times as great as in India, the tax paid by each individual in the Delta may be considered equivalent to 60 shillings in England, or half as much again as the people there pay. In judging of the proportional degree in which these sums must press upon the people of the two countries, two things must be considered; first, that on watered lands in this country, the produce is obtained at an expense and labour very far below that required in England, leaving of course a larger proportion of the crop disposable for the cultivators' profit and the expenses of the Government. But, on the other hand, the difference in the state of the society in the two countries, as respects mental cultivation in general, and the knowledge of the arts in particular, is such, that upon the whole the people of England could afford to give up a very much larger portion of the produce of their labour, for the support of the Government, than those of India. Indeed when it is considered that owing to the superior intelligence of the great body of the people, almost every operation is executed with less waste of time, labour and materials, and that, by the force of steam, of wind, of water and of horses, perhaps (in proportion to the number of the people) not less than thirty times as much power is in exercise in England as in this country ; and when to this is added the consideration that, in the former, an almost incalculable quantity of labour is *avoided* by the use of such machines as turnpike and railroads, canals, &c., it will probably be pretty evident that the proportion of the total power exerted by the community in India, which goes to provide for the support of Government, is prodigiously greater than the proportion in England. Of the produce of Indian labour, a considerable portion is indeed daily transmitted to England, and there employed in increasing the public stock of productive machinery; every native of India, at work in a paddy-field, is raising food for so many individuals employed in making steam engines, or laying railroads, in England. How desirable it is that he should rather be supporting men employed in such works in this country ! And this could with the most perfect ease be accomplished, if the Government would take up the capital of these servants on interest, and expend it upon such undertakings as would be most conducive to the comfort and prosperity of the Indian community.

The materials from which this memorandum has been drawn up have been taken from the records of the Tank Department, in the third division, which the acting civil engineer has obligingly permitted to be examined for that purpose.

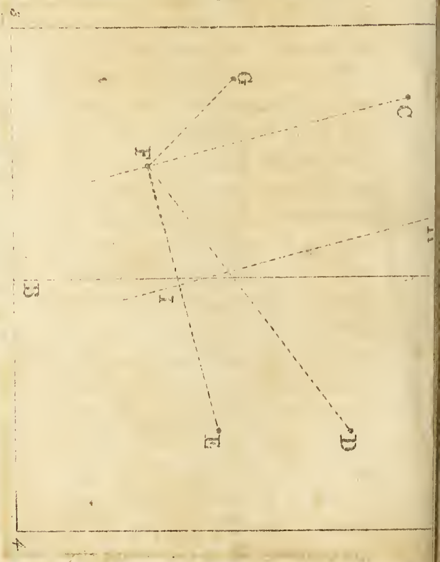
In connection with this annicut, a canal suited for traffic has been completed about forty-five miles long. It leaves the Colleroon immediately above the annicut, and enters the Vellaur at Porto Novo. The

Colleroon and Cauvery are both used for traffic to a very considerable extent; cotton, piece goods, saltpetre, sandal-wood, &c. are brought down from Coimbatore and Salem, and conveyed to the ports of Nagore and Porto Novo; but, as lines of communication, these rivers are comparatively of little use on these accounts; first, they are extremely shallow in general, and can only be navigated during the freshes, which are very uncertain, and seldom continue many days together, even during the S. W. and N. E. monsoons, and for many months in the year they are not navigable at all; second, in consequence of the current, and the want of a tracking path, it does not answer to carry goods up these rivers, and even very few only of the empty boats are taken back, so great is the labour of tracking or pulling against the stream, the greater part of the boats which are all circular baskets from nine to fourteen feet diameter, covered with buffalo leather, are taken to pieces at the ports, the leather packed up and conveyed back on bandies or men's heads, and the baskets abandoned. It is perhaps not quite certain that it would not answer to convey goods up the rivers; perhaps it is that the natives have not energy enough for such a traffic, but probably it would not be very greatly cheaper than land carriage. The advantage that the canal will have over the rivers, is, first, that by means of the annicut it will be kept regularly supplied with water, as long as there is any in the Colleroon, that is frequently during eleven months, and seldom less than ten, out of the year; second, as it will have a tracking path, it may be used for the conveyance of goods up as well as down; the current will vary from one to two miles an hour. As a continuation of this a cut of seven miles long has been ordered, to connect the Vellaur with the Cuddalore backwater, by which the water communication will be completed to within eleven or twelve miles of Pondicherry, and it is hoped that, at a comparatively trifling expence, cuts may be made to connect the different backwaters as far as Madras, from whence, by Cochrane's canal and the Pulicat lake, the communication is already open nearly to Nellore.

V.—*On a method of using* Sir Howard Douglas's *Reflecting Semicircle in Military Sketching.—By* Lieut. J. Campbell, Asst. Sur. Genl.

The method of using this instrument in military sketching, for the protraction of the place of a point by the angles subtended by it from two other known stations, is well known, but in this way the instrument can only be used in making small sketches of a camp, or of a proposed encamping ground, or of a fort, &c. where the extent is small, and the arms of the instrument are long enough to protract the observed angles

on the scale assumed. But in making an extended and accurate sketch of a country, it is necessary to find the situation of a number of stations all over it, from which the rest is drawn in, at least once in each square mile, if an accurate sketch of the detail is required or any thing more than the general features are intended to be laid down. The operation technically termed, finding the station, is that in which the situation on the draft of any particular place, is found by the angles observed as subtended from it by the known points around. For this purpose the instrument may be thus applied. Let 1 2 3 4, fig. II. represent the folding field sketch.



Draw the line A B, to represent the magnetic meridian at the place. Let C D F G, be points which have been laid down trigonometrically and let F be the station required to be found. With a surveying compass take the bearing of one of the points from F as of C, and draw the occult line H I, making the angle H I A, equal to the bearing of C from the meridian, (to protract this angle the circle will be convenient), and draw C F passing through C parallel to H I. Then it is plain that the required station F must lay somewhere in the line F C. With the circle observe the angle subtended from F between C and D, C and G, &c. and protract these angles by laying the instrument on the sketch with one of its arms parallel to the line F C, and move it until the line of the other arm intersects the points D and G, the angles protracted C F G, and C F D, will then be equal to the observed angles subtended by those points, and the place of the station as required will be at F. If the sketch is on the scale of one inch to a mile, the arms of the instrument will not be long enough to reach from every station as protracted to the points, but the line of the arm can be seen very nearly with the eye, and the intersection of several angles will ensure accuracy, or a ruler or a horse-chain may be used as an assistance.

These operations may all be completed in the most rapid manner without getting off the horse, and the method combines both accuracy and quickness.

VI.—*On the Practical application of the Problem of the Three Points in Surveying.—By* Lieutenant J. Campbell, Assistant Surveyor General.

The problem of the three points as it is called by the French, or the Townly problem by the English, is that in which three points are given in position, and the angles subtended by them form a third point, the distances from which to the other three are required to be found.

This problem appears by the English surveyors to have been thought of but little use in practice, and has been paid but little attention to, the methods generally given for its solution being operose and inconvenient in practice.

There are several methods of solving this problem, and, passing over the geometrical method which is given in almost all elementary works on Trigonometry, I shall proceed to make a few remarks on the general formula for its solution, obtained by analytical investigation, as given by Galbraith in his Mathematical and Astronomical tables at page 48, and in most French works. Let a and b (fig. I) be two of the given sides of the triangle, and π and P be the angles subtended from the station D by the points A, B, C, D—being the required station. The values of the unknown angles x and y being found, all the required quantities may easily be computed ; the formula given is

Fig. 1.

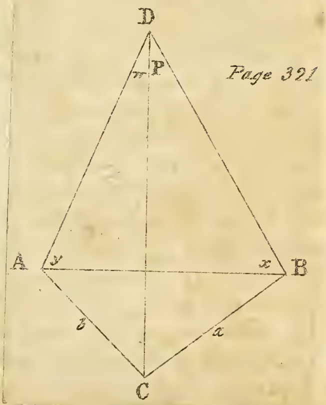
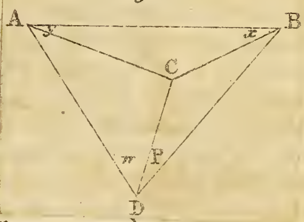


Fig 2.



$$\cot x = \frac{a \cdot \sin \pi \cdot \cot R}{b \cdot \sin P \cdot \cos R} + \cot R$$

$$\text{or thus.} \quad \operatorname{Cot} x = \cot R . \left(\frac{a \cdot \sin \pi \cdot}{b \cdot \sin P \cdot \cos R} + 1 \right)$$

but this will be found an inconvenient method, and very subject to error, as it is necessary to be careful to apply the cosine R with its proper sign. The value of $R = x + y$ is known by attending to the si-

tuation of the point D which if exterior to the triangle as at fig. I.

$$R = 360^\circ - (P + \pi + C)$$

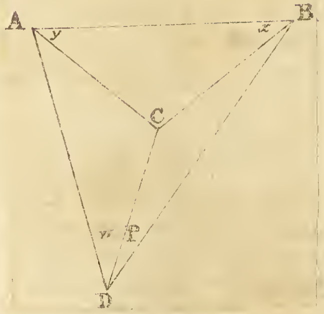
If interior as at fig. II.

$$R = \tfrac{1}{2}\,(C - P - \pi)$$

If the angle of the triangle is meant, as at fig III.

$$R = (C - P - \pi)$$

Fig. 3.



Another method is given by Puissant in his "Geodesie," I believe first proposed by Delambre, the solution of which is probably conducted in the same way as made use of by me at page 141 of this journal. In this the half sum of the angles x and y being known, the half difference is found thus—

$$\text{Tang } \tfrac{1}{2} \text{ diffr.} = \text{tang } (\phi \sim 45^\circ).\ \text{tang } \tfrac{1}{2}\, R$$

$$\text{Tang } \phi = \frac{a.\ \sin \pi}{b.\ \sin P}$$

the value of R being as before.

This method is far better than the last given, being much more easily applied, and admitting of the greatest accuracy, with being operose.

In testing the correctness of the quantity found, the value of the line D C may be computed from each thus :—

$$D\,C = \frac{a.}{\sin P.}\ \sin x. = \frac{b.}{\sin \pi.}\ \sin y.$$

which will not agree if any error has been committed.

There is another still more convenient mode of computing the values required, by first getting a rough approximation to the value of the angle x by a protraction on paper, and then trying the value of D C : thus, make

$$L = \log\,(a.\ \sin x.\ \text{cosec } P) \text{ and}$$
$$\lambda = \log\,(a.\ \sin\,(R - x).\ \text{cosec } \pi)$$

should the value of x have been taken correctly, 4 will be equal to λ; otherwise take,

$$L \pm D.\ \phi' = \lambda \mp \delta.\ \phi' \text{ where}$$
$$\phi' = \frac{L \sim \lambda}{D + \delta}$$

D = the tabular difference of the logarithmic sine of x.
δ = Ditto of (R—x)
ϕ' = the correction to be applied to x in decimals of a minute. Where x and (R—x) are both greater or both less than 90° : otherwise,

$$L \pm D.\,\phi' = \lambda \pm \delta.\,\phi' \text{ and } \phi' = \frac{L \backsim \lambda}{D \backsim \delta}$$

the sign being changed.

If Galbraith's tables are made use of,

$$L \pm \frac{D}{100}\cdot \phi'' = \lambda \mp \text{ or } \pm \frac{\delta}{100}\cdot \phi''$$

$$\text{where } \phi'' = \frac{L \backsim \lambda}{D + \delta}.100 \text{ or } = \frac{L \backsim \delta}{D \backsim \delta}\cdot 100$$

The mode of deriving their correction must be apparent, and it is not therefore necessary to investigate it. This method is very convenient and handy in practice, and the only objection to it is, that the differences are not great enough when both the angles are near 90°. To give an application of these methods :—

Let a = 3 miles
b = 2 ——
∠ π = 22° 30′ 0″
— P = 33° 45′ 0″
— C = 104° 28 39″

then because as in fig I. D is exterior

R = 360° — (P + π + C)
P = 33° 45′ 0″
π = 22° 30′ 0″
C = 104° 28′ 39″

160° 43′ 39″
360°

R = 199° 16′ 21″

	thus a =	3.	log	= + 0,477121
	y =	2 C.	log	= + 9,698970
π =	22° 30′		sin	= + 9,582840
P =	33° 45′		cosec	= + 0,255261
R =	199° 16′ 21″		sec	= — 0,025046
— 1.094556				= — 0,039238

$$
\begin{array}{lll}
+\ 1.\text{——} & & \\
\hline
-\ 0{,}094556 & \log & =-\ 8{,}975690 \\
\hline
\cot C = 199^\circ\ 16'\ 21'' & & =+10{,}456359 \\
\hline
\quad = -\cot x & & =-\ 9{,}432049 \\
\hline
\end{array}
$$

$$= -\cot x = -\cot\ 74^\circ\ 52'\ 3{,}''5$$
$$= +\cot\ 105^\circ\ 7'\ 56{,}''5$$

It will be easily seen how difficult this must be in practice and even in Galbraith the computation is wrong. Again by the next method,

$$
\begin{array}{lll}
a = 3. & \log = & 0{,}477121 \\
b = 2\ C. & \log = & 9{,}698970 \\
\sin \pi = 22^\circ\ 30' & = & 9{,}582840 \\
\text{cosee } P = 33^\circ\ 45' & = & 0{,}255261 \\
\hline
45^\circ\ 56'\ 9{,}''6 = \text{tang } \varphi & = & 10{,}014192 \\
\hline
\text{tang}\ \ 0^\circ\ 56'\ 9{,}''6 & = & 8{,}213193 \\
\text{tang}\ \tfrac{1}{2} R = 99^\circ\ 38'\ 10'' & = & 10{,}770100 \\
\hline
\tfrac{1}{2}\text{ diff.} = 5^\circ\ 29'\ 47{,}''1\ \text{tang} & = & 8{,}983293 \\
\hline
\tfrac{1}{2}\text{ sum} = 99^\circ\ 38'\ 10{,}''0 & & \\
\hline
105^\circ\ 7'\ 57{,}''1 = x & & \\
\hline
\end{array}
$$

Here the accuracy of the result may be carried to any extent, without any additional labour, merely by increasing the number of decimals in the logarithms—their difference in the result arises from the errors of the last calculation. As proof of the correctness—

$$
\begin{array}{lll}
\text{cosec } P = 33^\circ\ 45' & = & 0{,}255261 \\
a = 3. & = & 0{,}477121 \\
\hline
 & & 0{,}732382 \\
\sin\ x = 105^\circ\ 7'\ 57''. & = & 9{,}984674 \\
\hline
DC & = & 0{,}717056 \\
\hline\hline
\end{array}
$$

$$\text{cosec } \pi = 22^\circ\ 3'0 = 0{,}417160$$
$$b = 2. = 0{,}301030$$
$$0{,}718190$$
$$\sin y = 94^\circ\ 8'\ 24'' = 9{,}998865$$
$$\text{D C} = 0{,}717055$$

For the last method, suppose the value of x has been taken $= 105^\circ$ $9'$ then $(R - x) = 94^\circ\ 7'\ 21''$

$$\frac{a}{\sin P} = 0{,}732382$$
$$\sin x = 105^\circ\ 9' = 9{,}984637$$
$$L = 0{,}717019$$

$$\frac{b}{\sin \pi} = 0{,}718190$$
$$\sin (R-x) = 94^\circ\ 7'\ 21'' = 9{,}998875$$
$$\lambda \quad 0{,}717065$$

the difference or $L \backsim \lambda = 46$ and the tabular difference of the

$\sin 105^\circ\ 9'' = 57 = D$

$\sin 94^\circ\ 7' = 15 = \delta$ and because both the angles x and y are greater than 90° the sum of these difference is to be taken on $57 + 15 = 72$

and $\dfrac{L \backsim \lambda}{D + \delta} = \dfrac{4600}{72} = 63''$

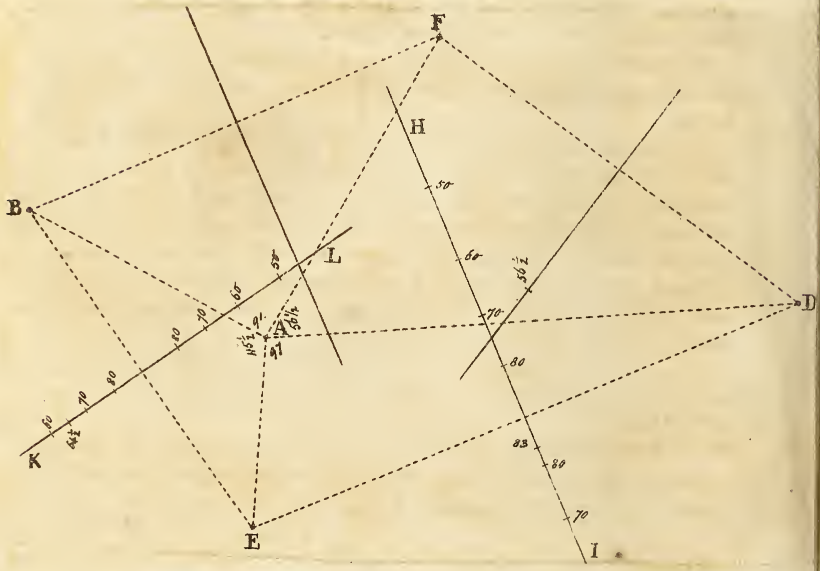
which being deducted from x gives it equal $105^\circ\ 7'\ 57'$ and $(R-x)$ equal $98^\circ\ 8'\ 24''$ as before found.

and $\dfrac{D}{100} \cdot \phi'' = .57 \times 63 = 36$
$$L = 0.717019$$
$$\text{D C} = 0.717055$$

and $\dfrac{\delta}{100} \cdot \varphi'' = .15 \times 63'' = 9$
$$\lambda = 0.717065$$
$$\text{D C} = 0.717056$$

as found before.

In military sketching, also, this problem may be applied with considerable advantage, when amongst hills, or on ground with points sufficiently strongly marked. Let B, E, D, F, Fig. 4, be four points



about twenty miles distant from each other, the situation of which has been ascertained with any of the common instruments, and it is intended to sketch in accurately the country adjoining them. Let these points be laid down on the scale of one mile to an inch upon drawing paper, mounted on cloth like a pocket map. Draw the occult lines BC, BF, FD, and DC, bisect them and draw in ink perpendicular to them H I and K L &c. &c. Then, with the radii of half the occult line, lay of the tangents of 5° 10° 15° to 40°, and mark them as shewn in the Fig. 85° 80° 75° &c.

Let A be the place of a station required to be found, from which the points B and E subtend an angle of 115½° and the points E and D an angle off 97° ; these angles being greater than 90° their supplements must be taken, namely, 64½ and 83°, then the leg of a pair of compasses

being placed in 64½° ; on the line K L, with the extent from 64½° to B, or E, let a faint arc be struck where the station A is supposed to be, and in the same way from 83° on the line H I, with the extent from 83° to E or D, let another faint arc be struck intersecting the former ; the place of intersection will be the place of the station A. Should more intersection be required to ensure accuracy, let the angles subtended by D C be 56½ then from 56½ on the perpendicular to the line C D, with the extent from 56½°, to C D, the arc will also intersect the two former in A ; and so on for more angles.

All this may be done while sitting on horseback, and the drawing in of the features round the station immediately proceeded with, without delay.

The method is as accurate as when a plane table is used, and will even shew the error arising from the angles not being reduced to the horizon, where the plane in which they are measured is inclined to the horizon 4 or 5 degrees. It is quite sufficient to lay down the scale of the tangents to 5° as the true place of the centre is easily guessed.

The method also possesses the advantage of protraction not being required in the field, and the great errors and inconvenience arising from their use is thus avoided.

VII.—*On the Granitic Formation, and direction of the Primary Mountain Chains, of Southern India.—By* Captain James Allardyce, 23*d Regiment Madras Light Infantry.*

Few countries afford so wide a field for investigating the phenomena of the granitic formation as Southern India : in the north of Europe, secondary formations so generally cover the primary, that the latter are in a great measure shut out from observation : in addition to this, the more interesting fossiliferous strata occupy a large share of scientific enquiry, while the less understood igneous rocks, having no key to their history, are comparatively neglected. It is for these reasons that inquiry regarding the position and arrangement of the early igneous rocks in this country, is an especially appropriate study for those who can direct their attention to such subjects ; and so far from being a hopeless task, it promises under all its advantages to afford much new information.

The circumstance most remarkable in the Indian granite formation is perhaps the great prevalence of that kind of rock called primitive trap, greenstone, or hornblende rock ;* it does not form as in other

* The Palaveram rock is a good example of the primitive trap : being nearly allied to sienitic granite, it appears to be sometimes distinguished by the same name—it has been

countries patches of limited extent, but surrounds and intersects the whole peninsula; it seems to have its regular place among the granitic strata, with which it is confluent at the line of junction, passing gradually from green to red and white felspar rocks: it generally cuts off and terminates all the other granites: possessing this character it may be considered the oldest rock here unfolded in the granitic series; for if the primitive mountains are the subverted fragments of a formerly horizontal crust, which all observation and experience tend to prove, then according to the laws of subversion that prevail in the more recent formations, the stratum found encompassing the others will be that which was earliest formed and originally undermost in the series.

The primitive trap together with its associate the small grained sienitic granite is by far the most extensive and continuous of the Indian rocks.* On the western coast it seems to extend uninterruptedly from Surat to Cape Comorin, or rather to Ceylon, for the mountains there appear to be of the same character as the western ghauts, and are besides nearly on the same line. From Ootacamund to the N. E. at least as far as Madras, this rock extends in full character, but does not constitute the mass of the eastern ghauts at Nakanary, which in this respect differs from the western chain. The mountains of the Northern Circars are said to form a very continuous and well-defined range of trap hills, but elsewhere in the line of eastern ghauts or between Salem and the Kistnah, the strata appear to be of various kinds. Connecting the western ghauts at Surat with the eastern at Balasore or Ramghur, is the Vyndiah range also of this trap: so that the trap or green felspar rock appears to surround the peninsula on every side. Numerous similar and smaller chains cross the interior, generally in a direction S. W. and N. E. Travelling westward from Palaveram where green felspar prevails, we do not again meet with the same rock until reaching the western ghauts on the opposite coast. The identity of the Palaveram rock with that of the

called also primitive greenstone, hornblende rock, and gneiss when distinctly stratified. The composition is, in most cases, at least two thirds felspar, of a bottle green colour, or usually some shade of green, which changes to a light sandstone hue in decomposition; mica, quartz, garnet, hornblende and schorl also occur but in minor proportions, the essential ingredient being felspar. In the western ghauts near Goa this trap consists of a paste of bluish grey felspar with scarcely any other ingredient, perhaps the distinguishing mark of trap that will apply most generally is its difference in texture from granite, the one being a compact vitrious paste, the other a more freely granulated compound—in this sense the term is here used, for any definition founded on origin or manner of eruption will not hold good with regard to the primitive traps.

* If sienitic granites are to be distinguished by the presence of hornblende it will be found that, according to the present unlimited application of the word, there is scarcely a granite in this part of India that might not be included as sienitic: but, if we regard them simply as intermediate between granite and trap, it is better at present, for the sake of perspicuity, to drop the dubious term sienitic granite, and pass on to the trap, which will include the granites next to it having a close texture and vitrious aspect.

western ghauts, the dissimilarity of the eastern range at Nakanary, and the non-occurrence of the green granite in the intermediate space, are circumstances indicative of a particular arrangement.

Primitive trap or greenstone does occur in some places, as between Biddadee and Muddoor to the westward of Bangalore, but it is of that basaltic kind which pervades alike every formation, and is found abundantly in the red granite districts: another example of this detached greenstone occurs on the eastern side of Bangalore, where from the height near Ooscottah a long narrow range of flat topped hills may be seen, extending in a semi-circular sweep from the vicinity of Nundidroog to the southward of Ooscottah, near which the hills pass. On examination of this ridge, the greenstone will be found, as in other cases, to have the vertically tabular structure, although the flat topped hills would, *prima facie*, lead to a contrary supposition. It is difficult to say what is the difference between these hills and the basaltic dykes, except that the former are on a larger scale than the latter: both appear to have penetrated the strata anterior to subversion.

In the direction of mountain ranges, although a certain order seems to prevail, yet there is not such regularity as in the direction of stratification, which often continues the same, while the direction of ranges may be various: both these points it is important to note in a geological survey; they might be easily registered, in the different districts, along with the meteorological phenomena. The direction of stratification at Ootacamund, on all the hills near the cantonment, is W. S. W.* at Trichinopoly the same, and at Nakanary not very different. The lines of stratification cross the ghauts diagonally at Nakanary, or perhaps more strictly speaking, the line of fracture running N. and S. crosses diagonally the lines of stratification. We see from this, that there are mountain ranges having their stratification parallel with their direction, and others having it oblique; it will follow also that if disruption take place across lines of subverted strata, a variously composed ridge will be the result; whereas if the dislocation proceed parallel with the subverted strata, there will be in consequence a continuity of the same rock elevated. This is a rule that will be found to hold good in most cases as applied to primitive strata, and, where secondary ranges occur, the subjacent rock is more to be considered as the true mountain ridge than the overlaying crust. The Gujunder Ghur hills, for example, although a sandstone range, are based on granite; owing their

* An exception to this occurs on the north side of the cantonment where the direction of a piece of gneiss or rather trap more stratified than usual runs N. and S. and has fallen besides to an angle of 45°., the dip being to the westward. This fragment includes at least three small hills the convexity and exfoliation of which have the usual direction with regard to the horizon and are not influenced by the oblique position of the rock.

superior elevation to the rising of the granite underneath: another example is the sandstone of the Naggery hills. It has been remarked that while the primitive trap ranges, with the exception of that on the western side (namely, the ghauts), have a tendency N. E. and S. W., inferior ranges supporting secondary strata run more N. and S.—it requires observation to prove how far this is the case.

Where any certain arrangement prevails, it of course affords additional facility in noting down the geological features of any country for reference, and if minor divisions can be effected by septarian lines of a frequently recurring rock, the labour of investigation is divided into parts: the trap ranges being the most regular and constant, would best answer this end. The Tanjore plain, bounded on the north by the Cauvery ranges, and on the west by the Paulghaut hills, forms a very distinct natural division; while the Mysore region, with the Cauvery ranges on the south, and the Malabar ghauts on the west, is the next succeeding. It is material to observe, that the successive rocks composing the area of this compartment, do not terminate in the eastern ghauts at Nakanary, but pass on to the trap chain on the coast.

Throughout the southern part of the peninsula, igneous rocks greatly prevail, there being scarcely a trace of aqueous strata; and among the primitive rocks clay-slate is wanting, although it is found in abundance further north: in certain places clay-slate and limestone tracts, of the transition series, are of vast extent, and, considering the almost invariable presence of valuable metallic ores in such districts, they are not the least interesting in a commercial point of view.

A careful inspection of the line of western ghauts in different parts, shews that the difference between the two levels has been produced by fracture: a disruptive force having broken the surface of the land into an upper and lower level, as shewn by an abrupt and well defined escarpment. The mountain masses, although in themselves of great size, and originally perhaps of considerable elevation, yet owe the greater part of their height to the same cause; and it may be mentioned, that this western fracture appears to have been guided by a previously existing range of primitive trap, from which it does not deviate during its course. We have here the rather unexpected fact, that fractures take place more readily, when the subverted fragments are largest, or where considerable mountain masses existed before: this is not a new observation as applied to direct eruptions, but the same circumstance has not been particularly noticed, as occurring where no volcanic matter has been immediately erupted.

The universally vertical stratification of the primitive igneous rocks, does not admit of the supposition that they have become concrete in the position they now hold: had such been the case, the stratification would have been horizontal or convex, as seen in the flœtz trap, and in

volcanic hills still existing unaltered. That the whole of the granite rocks, however, as well as the more recent basalts, have resulted from successive streams of lava, scarcely can be doubted : at the same time it is impossible that they could have been erupted as they now stand : they appear to be subverted fragments, belonging to a former crust which has suffered a general *bouleversement.* Admitting the vertical position to be the result of such an event, the surface of the crust is unexpectedly level, for all considerable inequalities are referable to subsequent dislocation.

Another phenomenon connected with the question of subversion is the exfoliation of mountain masses, as well as the smaller fragments, in concentric layers. This is interesting as being the cause to which the remarkable convexity of the trap and granite hills is attributable : it is by no means confined to this country, the same convexity of surface being found everywhere, both in the primitive and transition rocks. On the slightest examination it will be distinctly visible, that the layers exfoliate, without any reference to the original structure or stratification of the rock itself; in gneiss, and granites having vertical stratification, or rather having the strata placed in a vertical position, we see the layers scaling off horizontally in cavo-convex fragments, the fissures cutting across the original lines of stratification ; and not only this, but, in porphyritic granites, a single crystal of felspar is often intersected, in several places, across its own lines of cleavage. This is a satisfactory proof that exfoliation is in no way influenced by the original structure of the rock, but is, perhaps, in some way connected with the radiation of heat from the surface : whatever may be the cause, the process itself is sufficiently apparent, and in its effects important to theory, as it appears to have altered very considerably the outline of the primary rocks. We learn, also, by the numerous instances of half demolished peaks, that the exfoliation does not proceed from the top downward, but that the peak or fragment is at once truncated near the base in repeated concentric lines, leaving a convex projecting surface. The thick plates or caps may be often seen still adhering to the convex surface, in which situation they usually split into divisions, each separate piece again exfoliating in its own mass. Many of the blocks on hill-tops are bouldered, but, when these blocks are of the same nature as the rock on which they rest, and have their lines of stratification also vertical, it may be taken for granted that they have at some time formed part of the subjacent rock, and are not transported boulders. The convexity of the dome-shaped hills, with their exfoliating surface, is very apt to lead to the conclusion that they are volcanic masses erupted in a fluid state on the spot ; the layers have been taken for successive flows of lava, while corresponding craters have been sought for in vain : these layers have also sometimes been confounded with gneiss.

It has been already stated that dislocation has taken place most readily where the fragments are largest, but it is a question by what kind of force this effect has been produced; whether the impetus has passed along those lines where the fracture is apparent, or, whether the pressure on the surface has been generally distributed—in which latter case the crust might have been expected to give way where there was the least resistance. Although it is more likely that expansive force should prevail over a considerable extent at one time, yet it is not clear by what rule the most ponderous and solid fragments should be the most affected by it.

In instances where hills, or tracts of table-land, have been forced up from the general level, the summit usually corresponds in its superficial crust with the plain from which it has parted, while the escarpment, or intermediate space, is wanting in this crust common to the two proper surfaces. This is seen in the ghaut region, the escarpments, even when not very steep, being deficient in the iron clay and diluvial gravel: the want of these on the fractures, shews the elevation of the hills and table-land, to be a more recent geological event than the deposition of the diluvial gravel. In the Konkan north of Goa the elevation of the ghauts is clearly pointed out as subsequent to the formation of laterite: the table-land is covered with a thick crust of this substance, as well as the lower level of the Konkan: and hills, which appear rising from the low ground as detached portions of the table-land, are flat topped, with a crust of the same laterite, while their slopes, like the general escarpment of the ghauts, is covered only with a loose debris.

It has been remarked that granite in America is found at a much lower level than in Europe: this is also the case throughout the south of India, by granite—meaning always granitic rocks; for a regularly crystallized compound of quartz, felspar and mica is not to be expected.* The Carnatic, and several other similar tracts, occurring along both coasts, are, as granitic plains, surprisingly level: the slight tertiary diluvium with which they are covered, cannot be considered as a principal cause of this uniformity, for the rock itself is everywhere found near the surface: every appearance here indicates that the granitic formation has at one time been a great deal more flat than it is generally

* The only sure method of identifying one kind of granite with another, is by preserving types or average specimens of each distinct variety for reference: little can be understood by description, and no general rules can be laid down for definition: they do not vary so much in composition as in mode of crystallization and colour.†

† The author appears to lay too much stress on the colour, composition and mode of crystallization of rocks, which, without attention to *geological position*, can only be considered vague and insufficient criteria. So much do hand specimens mislead, that fragments of many species of primary granite could not be distinguished, as far as mere external characters go, from the overlying rocks of the trap formation.—Editor.

understood to have been. The Neelgherries rise from a plain nearly as level as the Carnatic, and their summit bears evident marks of having been once on a level with the Mysore and Coimbatore plains. Like elevated regions in other parts of the world, the Neelgherries shew also traces of a diluvial current; that is, the gravel and loam are arranged in such a manner as could only take place by deposit from water; the gravel being lowest in a thin stratum by itself, with the lighter loam covering it, to the thickness of several feet, and without gravel. The carbonaceous black cotton soil occurs here as on the plain, and it is found under the general gravel line as well as above, shewing it to have been lodged among the broken strata, before the passage of the later diluvial current over the surface: the indications are that this current has passed before the hills attained their present elevation, which last seems an event so recent, as to be only anterior to the formation of kankar. As no secondary strata occur near the Neelgherries, none need be expected on their summit; but, on the eastern ghauts at Naggery, sandstone is found, and serves to point out that the hills there have been elevated since the sandstone period. It is probable that the other parts of the ghauts have been raised about the same time: every thing tends to show that the elevation of these ranges is a comparatively recent event.

Taking a general view of the granitic phenomena the following simple geological facts are discernible: that all granite is, on a larger or smaller scale, of a structure distinctly stratified;* that the structure of granite no where bends from a mountain range under the less solid strata of the plain; that its position, as ascertained by the direction of its structure, is, like that of the primitive schists, almost invariably vertical, and in adjacent fragments; that the principal mountain masses owe their height to dislocation, and are not original inequalities; that the granite formation, throughout its whole extent, has the appearance of having been perfectly level, anterior to the present dislocations of its crust; that basaltic dykes penetrating the primitive strata do not expand on the present surface, and, where secondary formations occur, the dyke is not found continued into the overlaying strata—a proof that such dykes existed before the primary strata were broken and subverted.

The structure of the primitive igneous rocks being vertically tabular, extending in right lines quite up to the surface, whether that surface be rugged, smoothly convex, or horizontal, is directly opposed to the

* It has been maintained that the structure belonging to gneiss and granite ought not to be called stratified, but there is no other term that expresses so well the laminar appearance of the igneous rocks: schistose will not comprehend the thick bedded varieties, and tabular is more applicable to the mechanical deposits. Mont Blanc is said to be vertically stratified, and its granite contains hornblende. See Bakewell's Geology.

probability of concretion in the present position of strata. It has certainly been suggested that vertical structure may be the effect of crystallization on a large scale, but this hypothesis is unsupported by analogy on the smaller scale, and is quite at variance with existing appearances in the rocks themselves.

It is in the larger masses that the grain or direction of structure can be most correctly taken: the smaller fragments are often irregularly disposed and they are liable besides to be confounded with the superincumbent schists. The relation of the newer schists to the subjacent strata has never been fully explained, but they are certainly two distinct formations, and of different date. They may be seen to good advantage on the island of Seringapatam, where the older strata, having a red felspar, are easily distinguished from the schists, which have invariably a white or grey felspar.

With regard to dislocation as the general cause of inequalities, the eastern ghauts may be considered a fair example: this range seems to be solely owing to a cross fracture of the strata. The observer, looking along the hills at Nakanary, will at once perceive that they are of a different character from the southern or Cauvery chain, bounding the table-land on the extreme south, and afterwards stretching into the plain. The trap hills, extending from the Neelgherries eastward, which for the sake of distinction may be called the Cauvery chain, are in many places four thousand feet high, while the Nakanary ridge is scarcely more than half that height: the latter, although so low, is far more rugged than any part of the western ghauts; while the hills are more numerous, and widely extended into the plain. On examination of the granite it will be found of that kind which usually forms the area, and not the boundary, of the Mysore district: the same variety of white granite continues from Sautghur to a considerable distance above the Nakanary pass, no change being perceptible at the ghaut. The point, at which this white granite ridge appears to commence, is near Salem, but the exact course of the different ranges here requires to be more correctly ascertained. In maps of the peninsula the eastern ghauts are always formally laid down, probably as being the boundary between the two levels, but the high mountains, extending by Salem and Gingee to Madras, are comparatively unnoticed.

Geologically viewing these chains in conjunction with the table-land, it appears that the surface, nearly as far to the eastward as Salem, has been forced to a considerable height, with the Cauvery ranges for its boundary; but beyond this it breaks short of the trap ranges, and the dislocation runs north, through the interior of the basin or compartment, towards Nakanary. The fracture, in this instance, departs from its usual course, and excludes the northern part of the Carnatic from the level of the table-land. The eastern ghauts preserve nearly the

same character, until reaching the latitude of the Naggery hills, where green felspar strata again occur. The connection of these with the ghauts might be determined by taking their direction; as long as the direction of the strata continues E. and W. while that of the ghauts is N. and S. a progressive change or succession of strata may be looked for: and different rocks, which originally had nothing to connect them into a mountain chain, receive, by cross fracture, the new character of elevation in a common line.

Superior elevation has been considered an usual character of the primitive rocks; regular crystallization has also sometimes been insisted on, as a mark of early formation: the following observations on this head apply to the south of India. Rocks of confused crystallization, as trap and sienitic granite, have the highest elevation, and at the same time the greatest depth, while the more perfectly crystallized granite is found at moderate heights or on the plain: as this elevation is, in every instance, a protrusion of fragments, or rising of a part above the general level, it follows that where the greatest dislocations occur the understructure will then be revealed to the greatest depths; this, along the escarpment of the western ghauts, amounts perhaps to four thousand feet, the rock seen being still the trap and sienitic granite, disposed as usual in vertical strata. Where the original surface has not been raised, even the primitive rocks remain at a very low level: while the convex hills on the Neelgherries have attained an elevation of seven thousand feet, hills, of precisely the same description, remain in the plain of Coimbatore at an elevation of little more than four hundred feet; and, following the course of the same rocks towards Madras, we find them, at the level of the sea, covered by tertiary formations, and by a sea-beach of the present period.

Of the Himalayan chain we are told that the principal valleys are perpendicular to its direction, running N. E. and that the escarpments are generally on the N. W. side, while the S. E. is shelving; but we are entirely ignorant regarding the direction of strata, whether the chain in its progress crosses many different kinds of rock in succession, or whether there are continuous rocks of any one kind extending from Bootan to Cashmere. Gneiss is said to be the most predominant of the primitive rocks and strange to say "gneiss reigns paramount in the Andes": the fact seems to be that all granite, when fully exposed to view in large masses, is more or less stratified; and hence is as liable to be called gneiss as granite. Much of this gneiss may on comparison prove the same as our primitive trap, which appears to be a very widely extended rock, for green granite is mentioned as entering into the composition of the Hindoo Koosh.

VIII.—*The Study of Botany recommended, together with a Prospectus of Dr.* Zenker's *Plantæ Indicæ.—By the Reverend* Bernhard Schmid.

An universal diffusion of the knowledge of Botany is highly desirable, not only on account of the many important discoveries which by its means may still be made in economical and medicinal respects, but even more so on account of the benefits which our minds derive from the pursuit of this study. It is well known that men, whose minds were abundantly enriched with the stores of knowledge, and with the means of mental enjoyment, as Rousseau and Sir William Jones, acquired and successfully cultivated this science in their advanced age, and (the former particularly) obtained thereby relief and consolation which he did not find any where else;—" for," (says a noble-minded and elegant writer on Botany), " what occupation is more able than the contemplation of Divine Wisdom in the beautiful economy of Nature, to deliver the soul from the feverish agitation of worldly pursuits, and to soothe a wounded spirit? The man who loves Botany for its own sake, knows not the feelings of envy, jealousy and rivalship, nor is he dependent for happiness on situations and scenes that favour their growth. He would find himself neither solitary nor desolate, had he no other companion than a " mountain-daisy," that " modest crimson-tipped flower," so sweetly sung by one of Nature's own poets. The humblest weed or moss will ever afford him something to examine or to illustrate, and a great deal to admire. Introduce him to the magnificence of a tropical forest, the enamelled meadows of the Alps, the wonders of New Holland, or even to the dwarfish plants of Lapland or Terra del Fuego, and his thoughts will not dwell much upon riches or literary honours, things that

" Play round the head, but come not near the heart."

And double delight and benefit will the study of the book of nature afford to him, who knows already the true fountain of peace and happiness, and who loves and studies with equal care the book of Revelation; for he finds that they illustrate each other mutually, and that the study of the one gives continually new zest to the study of the other.

And if Botany is useful and suited to adults, it is perhaps still more so to children and youths;—and Sir James Edward Smith (the writer just cited), in his Introduction to Botany states that in Sweden, where Natural History is generally introduced in schools as a branch of education, its beneficial effects are evident, as (according to his declaration) " there are no people with more acute or better regulated minds than the Swedes."

Views like these have induced the writer of this paper to devote a

portion of his time and attention, to contribute, as much as in him lies to the spread of the knowledge of Botany in India; and he can testify that not only the bodily exercise in the fresh air, necessarily connected with this alluring and delightful pursuit, but also—and perhaps still more—the *motive,* have greatly contributed to benefit his health and spirits. In the temple of nature, and in the instructive society of the innocent, peaceful and altogether lovely children of the dewy field and of a vernal sun, he has often felt himself nearer to the Creator than in the choicest company of men or books; and he has returned to his more laborious duties and occupations, invariably with renewed elasticity and cheerfulness of mind.

It would be quite superfluous to add to the above facts any other; suffice it to observe that the study of Nature, and more particularly that of Botany, *which is the most easy of access to all* kinds of individuals, prepares the youthful mind for the study of many other sciences, allures and inures it, in the most pleasant and imperceptible manner, to *perseverance* in any other pursuit, gives it solidity and, more particularly, the habit of observing, comparing and distinguishing accurately, cultivates a taste for simplicity, order and beauty; and, far from destroying the spirit of emulation, it rectifies and ennobles it, so that this most powerful incitement to action may not prove a poison to the peace of the individual or to the happiness of others.

Since the Neelgherries nourish so many decidedly European genera of plants (at Ootacamund and in its vicinity), and at the same time so many Asiatic and tropical plants (at Kotagherry, Billical, and further down the passes to the foot of the hills), Dr. Zenker's work, entitled *Plantæ Indicæ* &c. is better calculated than perhaps any other work of the kind, to assist both in *commencing* the study of Botany, and in *continuing* it, whether they return to the low-country or to Europe. They will find in this collection, engravings of plants so similar to other species in Europe, that they will be able with their aid to classify, without the least difficulty, many of those plants which they may meet with in England, or during their residence on the Continent; whilst other engravings will, with equal facility, make them acquainted with plants which they may find in any part of India, or in other countries within the tropics.

The writer of this paper, being convinced that the study of Botany, is particularly suitable for ladies, and an important branch of the education of children, even when they are still under the care and tuition of their mothers, has resolved to furnish an English translation of the Latin descriptions which accompany the engravings; and to add, after the publication of each tenth number (ten decades will form a volume) such an English index, as will contribute to facili-

tate the study. Thus each volume will constitute, and will be useful as, a separate work.

But if this plan of publishing an English translation should not be executed, or not speedily, the excellent and laborious work of Dr. Wight and Mr. Arnott (the "*Prodromus of the Flora of Peninsular India*"), written in English and containing the description of a number of Neelgherry plants, will, in a great measure, supply the place of such a translation, especially for those who reside in India; and I cannot but seize this opportunity to recommend the "*Prodromus*" strongly to every student of Botany.

As the author of the "*Plantæ Indicæ*" hopes to furnish the decades in quick succession and increasing perfection, if encouraged, and enabled to do so, by an adequate number of subscribers *to the first volume*, I beg my friends and every lover of science and art, to make the work known in their respective circles, that I may be able to inform Dr. Zenker how many copies are required for India.

A number of plants and shrubs have already been raised at Jena, from seeds sent from the Neelgherries. Neither will it be uninteresting to botanists to be informed that Her Imperial Highness, the Grand Duchess of Saxe-Weimar, has been graciously pleased to grant the expenses of building a green-house and stove, expressly for plants from the Neelgherries and other parts of India; and has likewise granted a piece of land for trying to acclimatize the Neelgherry trees and shrubs, and to ascertain their nature and virtues; so that it may be reasonably hoped that every succeeding decade will recommend itself to the public by greater perfection.

It is difficult at present to ascertain what will be the exact price of each number. At Jena where it is published, it is four Saxon (heavy) rix dollars, and a mercantile friend calculates that the price, in India, will be about four rupees each decade. At all events, since we do not seek pecuniary emolument, but the advancement of science for the public good, I doubt not that it will be easily settled to the satisfaction of all parties. To non-subscribers the price will necessarily be higher.

IX.—*Notes on the climate of Coorg, (with a Table).*—*By Surgeon* R. Baikie, *of the Thirty-sixth Native Infantry.*

The principality of Coorg (Kodoogoo more correctly) is situated on the verge of the western ghauts, the mountains on the west rising abruptly out of the plains of Canara and Malabar. It consists of a succession of lofty narrow ridges (inclosing valleys of various extent) parallel to each other, commencing with a high, often precipitous

abutment to the west, and following the general direction of the whole of the western ghauts, namely, from N. W. to S. E. until their termination in the plains of Mysore and Wynaad.

The most remarkable elevations are Soobramany* (Poopagherry in Canarese) in the northern range ; Teeteebetta (fire mountain) in that extending from Tully Cauvery and Tadiandamole† in the terminating range to the south. The Brumenagherries, which form the boundary between Coorg and Wynaad are also of great height. No part of the country can be strictly called plain, as, though on looking from the heights, the large valley between Mercara and Naknaad (about eighteen miles by thirteen) exhibits a level appearance, on descending into it, it is found to consist of a succession of low ridges with narrow valleys between them, the lowest forming the bed of the great river Cauvery.

The same is the case in Kiggutnaad to the south-east though here the ridges are less abrupt.

To the north of Mercara the ridges are exceedingly abrupt and steep, the valleys being little else than the beds of mountain torrents hollowed out to a great depth. Due west of Mercara the face of the country is looked into numerous rounded knolls like tea cups reversed, and strongly resembling on a smaller scale, the country west of Ootacamund on the Neelgherries.

The whole country, with few exceptions is covered with forests, more or less dense ; but seldom so impervious or clogged with underwood, as to come under the denomination of jungle. In Kiggutnaad and towards Mysore, however, bamboos make their appearance, and the forest becomes thick jungle filled with wild animals of all kinds, the same is the case on the western slopes descending into Malabar.

Having had neither leisure nor opportunity to make myself acquainted with the geological characters of the country in detail, I must restrict myself to observing that they strongly resemble those of the Neelgherries, so ably described by Doctor Benza, the principal rocks being sienite, granite and greenstone, and the subordinate ranges being uniformly capped with a thick stratum of lithomargic earth, consisting of detritus of granite or sienite in every stage of decomposition, cemented by argillaceous earth, and coloured by oxide of iron. Large masses of felspar of a cream colour, partially decomposed and in the state of what is called porcelain clay, are also of frequent occurrence.

The zoology and botany of Coorg, offer a rich field to competent observers. I wish I could flatter myself with the hope of being able to assist in exploring it.

* 5682 feet above the sea (T. J.).

† 5781 feet above the sea (T. J.).

To come to the more immediate subject of these rough and hasty notes—the climate of Coorg is materially modified by the following circumstances :

1*st.* The height above the level of the sea, the country in the neighbourhood of Mercara being, at a rough estimate, about four thousand five hundred feet above the sea, and the valley between that and Nacknaad about three thousand seven hundred or three thousand nine hundred.*

2*dly.* Its vicinity to the western coast.

3*dly.* The abrupt rise of the mountains on the western side.

4*thly.* The valleys between the ridges being all open to the north-west and south-east.

Accordingly, we find that the temperature is much below that of either Malabar or Mysore, that the monsoon rains fall with great violence, and last for nearly half the year ; and, finally, that the temperature is remarkable for its equability.

Temperature.—The temperature of Coorg is one of the most moderate and equable in the world, the *daily* range in doors never exceeding 6° or 8°, often not beyond 2°, and the thermometer seldom rising higher than 74° nor sinking below 60°. In the open air, the range is a little higher during the dry season, the daily extremes being between 52° or 53° and 68° or 70° ; the annual extremes are probably 52° and 82°. The want of a maximum and minimum thermometer, prevents my even guessing at the mean annual temperature, but it cannot exceed 65° or 66°.

Pressure.—The maximum of the barometer occurs, during the dry season, the highest noted being 26.220, and the lowest in July during the monsoon 25.912. The greatest daily range observed was .076, the mean daily range, which is very regular, .050. The diurnal maximum occurs at 10 A. M., the minimum at 5 P. M. with such regularity, that I have often detected an error in the supposed time by looking at the barometer at these hours. The barometer appears to offer no

* These must be taken as merely approximative, both of the barometers in my possession being liable to doubts of their accuracy, as to the *absolute* height. The following are the heights of some of the principal points, as deduced from the temperature at which water boiled, corrected by Prinsep's tables. The thermometer employed was a very accurate one by Dollond, and on comparing the results with the elevations of the principal mountains ascertained trigonometrically, I consider them *nearly* correct.

Mercara - -	feet	4506
Naknaad palace -	,,	3979
Soorlaby (northern range)	,,	4527
Bittatoor (near Mercara)	,,	4824
Veerajenderpett - -	,,	3399

indication whatever of approaching changes of weather, and I have not been able to detect any influence of the lunar phases on it.

Moisture.—The hygrometrical state of the atmosphere during half the year is that of extreme moisture closely approaching to saturation. During the dry season it is occasionally very dry—and sometimes undergoes most remarkable fluctuations* without evident cause, and without any perceptible difference to the eye or feelings.

A few detailed observations on each portion of the year may find a place here.

The months of January and February are cold and excessively dry—the range of temperature is considerable (from 53° to 70° or 72°), the mornings and evenings to the feelings excessively cold, while the heat of the sun in the middle of the day, is tempered by a constant cold breeze from the north-east; but which frequently blows with such violence, as to raise clouds of dust and become unpleasant.

In March the cold of the nights becomes less sensible and the days are warmer while the wind is less violent, the air still continues in general dry, but fluctuates considerably.

April and May are usually very pleasant months, the heat of the day which begins to be oppressive out of doors, being tempered by frequent heavy showers and thunder storms ; occasionally, though rarely, there is some closeness in the air ; but the nights are almost always cool.

In June the monsoon sets in, but at variable periods of the month—the commencement is seldom violent, but about the end of the month, the rain frequently falls in torrents. Between the 22d and 27th of June 1835, there fell twenty-seven inches of rain, nearly equal to the aggregate fall in England in the course of the year.

This continues during July, August and September, with occasional short intervals—the air is loaded with moisture,—the sun is scarcely ever seen ; and when the rain ceases there is usually a dense fog. The temperature is wonderfully equable, the extremes in the open air being 56° and 65°.

In October there is an interval of bright and beautiful weather, rendered the more delightful by contrast and by the intense green of the luxuriant vegetation,—about the commencement of the month the wind usually settles in the north-east, and when strong it is piercingly cold.

November is a disagreeable month, as indeed it is, I believe, in every corner of the northern hemisphere. The weather is blustery, cold and showery, and there are frequent cold heavy fogs.

In December the rain subsides into fog, and towards the end of the month settles into bright clear cold weather, the mornings and evenings intensely cold to the feelings.

* The dew point, in March last, between the 13th and 20th, fluctuated from—17° (centigrade) to + 16.8.

As respects the very important point of health, I have no hesitation in saying that, I consider the climate of Coorg as eminently adapted to the European constitution, provided there exists no tendency to visceral congestion. Not a single case of disease in people of this class, has come under my observations which could even remotely be attributed to the climate.

Natives of the low country suffer a good deal at first from fever (of the intermittent type) and bowel complaints, greatly owing, no doubt, to their imperfect clothing, sleeping on the ground and eating raw vegetables. On becoming acclimatized, however, they are as healthy as in the best parts of the low country—and what is singular, the monsoon is the most favourable season. At this moment (July 1836) there are only twelve cases in the hospital of the 36th, nine of which are accidents. The few casualties that have occurred within the last eighteen months, have been principally from congestion of the lungs, always a formidable complaint among natives. To one class of complaints the climate appears decidedly inimical, namely, cuts, wounds or sores, which are always tedious, and often totally unmanageable, without change of air. (This is a peculiarity which I believe it shares with the other moist climates of India ; at least such is the case on the Malabar coast, at Bombay, and on the coasts of Arracan and Tenasserim).

The time at which the military suffer most is the dry season, evidently from exposure to the greater variations of temperature to which their duty, as guards and sentries, subjects them. On the other hand the Coorgs consider the period immediately preceding the monsoon the most sickly*—particularly in the lower parts of the conntry bordering on Wynaad and Mysore. During the months of April and May if much rain falls, dysentery and fevers prevail to a great extent among the Coorgs, and are very fatal—the latter so much so, as to be called Rög, or epidemic. When in Keggutnaad, this year, an immense number of the inhabitants applied to me for advice and assistance, the principal affections being jaundice and dropsy, depending in chronic enlargement of the liver and spleen. They do not appear to be acquainted with any mode of treating these complaints, beyond the use of simple sudorifics and astringents. Dysentery appears to be most severe among the children and young people—consumption is not common—small pox is not of frequent occurrence, but very fatal when it does occur.†

* The same is the case in the jungles surrounding the base of the Neelgherries. While in the jungles of Candeish and the Tirhaee in Bengal the close of the rains is the most deadly period.

† The Coorgs have very little prejudice against European medicines and treatment, and submit readily to vaccination, with the preservative effects of which they are well acquainted. Great difficulty is found in keeping up vaccination among them, owing, I conclude, to the damp nature of the climate.

From the following statement, with which I have been furnished by my friend the superintendent of Coorg, and which he regards as nearly accurate, the population appears to be increasing and the average mortality not considerable :

	1835.	1836.
Total population	57,569	58,957
Increase*		1388
Births in 1835-36		2323
Deaths ......do		1675 or

1 in 35.5, which is below the average of several countries in Europe.

The monsoon proves fatal to great numbers of bullocks ; and several officers lost valuable horses, the first year that the regiment was stationed here; the latter died of a severe form of what is called vives (Laringitis) in Europe—since that time we have always sent our horses to Hoonsoor or Fraserpett, on the Mysore border, during the rains ; and it appears that the Rajahs were obliged to adopt a similar precaution with regard to their horses.

Fraserpett, above-mentioned, is situated on the Cauvery, on the site of an old fort of Tippoo's called Khooshalnugur—the country round it is nearly flat, and thickly wooded—during the monsoon little or no rain falls there ; and the climate is delightful, though, from its being one thousand two hundred feet lower than Mercara, the heat is occasionally oppressive in the middle of the day.

The subjoined table exhibits a monthly abstract of the daily observations made during twelve months—and, though very imperfect, will give some idea of the principal facts interesting to meteorologists. As before observed, the absolute height of the barometer is not to be depended on, it having been refilled without the possibility of comparison or adjustment at the level of the sea, and the want of a maximum and minimum thermometer, leaves us in the dark as to the absolute *mean* temperature.

The instruments are placed in a detached building, over the inner gate of the fort, perfectly isolated, and open to atmospheric influence on every side. The roof is covered with a thick thatch, and the sides venetianed; the interior is four and half feet square; and the instruments are suspended on a frame in the centre, three and a half feet from the ground. The barometer is by Newman; of the thermometers, one is a very fine one by Jones, one by Robison, and the third by Dollond—all agreeing exactly in their indications. The pluviometer (Howard's) is outside, on the same platform.

Mercara, *July* 1836.

* Partly no doubt owing to emigration from Mysore and Malabar.

Monthly Abstract of the Atmospherical Register, kept at Mercara in Coorg, from 1st June 1835, to 31st May 1836.

Months.	Mean temperature. Therm. Fahrenheit.		Mean pressure. Barometer corrected to 32° Fahrenheit.		Mean of hygrometer at 10 A. M.					Total rain, inches.	Mean evaporation in 24 hours.	Prevailing winds.
	6 A. M.	10 A. M.	10 A. M.	5 P. M.	Wet bulb.	Difference.	Quantity of moisture.	Dryness.	Dew point.			
1835 June	66.7	69.9	—	—	—	—	—	—	—	44.77	.020	W. N. W.
July	65.4	67.7	26.000	25.970	18.5	1.28	223.1	28.4	17.2	20.80	.039	W. N. W.
Aug.	65.	68.	26.007	25.980	18.6	1.	220.	24.	17.4	23.25	.030	W. N. W.
Sept.	64.	68.	26.050	26.010	18.3	1.8	210.	40.	17.	13.53	.030	W. N. W. E. N. E. N. N. E.
Oct.	65.	68.	26.070	26.020	18.8	2.	220.	40.	16.5	10.24	.035	W. S. W. E. N. E.
Nov.	63.	67.	26.115	26.080	17.7	2.8	200.	60.	14.5	2.18	.045	E. N. E. N. N. E.
Dec.	56.	64.	26.140	26.100	13.3	3.4	140.	75.	8.9	—	—	N. E.
1836 Jan.	53.	64.	26.160	26.100	11.	4.1	100.	120.	2.2	—	—	N. N. E.
Feb.	56.	69.	26.172	26.135	12.5	7.	115.	160.	2.	—	.100	E. N. E.
Mar.	61.	73.	26.140	26.070	13.4	8.5	130.	154.	1.1	.02	.105	N.N.E. N.N.W.
April	64.	75.	26.103	26.056	18.3	5.2	210.	134.	13.	1.87	.057	W. N. W.
May	64.	72.	26.090	26.040	19.2	3.2	212.	64.	16.	2.48	.052	N. N. W.
Genl. means.	61.9	68.9	26.097	26.051	16.3	3.6	188.	81.	11.4		.052	

Total fall of Rain....119.14

GENERAL REMARKS.

The monsoon set in on the 31st May, but shewed no violent effects till towards the end of the month. The mornings were damp and foggy, the heavy showers occuring in the evening. The last six days, the rain fell in torrents.

The monsoon continued very mild during this month, and there were intervals of fair weather. The equability of the temperature (the daily range not exceeding 4°), is remarkable.

The early part of the month was foggy, with little rain. On the 11th, the monsoon set in again, and continued, with little intermission, till the end of the month.

The rain continued steadily till towards the end of the month, when the wind changed to the east and the rain diminished. The period of the equinox was marked by some heavy thunder storms.

The early part of the month was damp and foggy, with occasional rain; about the 20th, the wind settled on the N. E. quarter, and it became colder. Heavy rain from N. E. on the last ten days.

The N. E. monsoon gradually cleared off, and may be said to have terminated about the 17th, with a heavy thunder storm. The weather then became cold and foggy, with high winds.

The early part of the month continued foggy and damp, but afterwards cleared up, and became clear, bright and fine, with very high winds. Mornings and evenings very cold.

The weather throughout this month was bright and clear. Mornings and evenings cold—heat of the sun tempered during the day by a constant cold wind from N. E., often amounting to a storm.

Much the same as the last, but rather hotter in the middle of the day, and less wind. The hygrometrical state of the atmosphere varied remarkably (dew point varying from 13.2 to 7.1), without evident cause.

First part of the month dry and warm, latterly cloudy and close; a good deal of thunder. Dew point varied from 16.8 to 17.

Occasionally dry and cool at Merkara; much rain fell all round; a few thunder storms.

A most delightful month, weather cool, clear and fine, much less rain than usual. A great deal of sheet lightning, with but little thunder.

X.—*Account of a Railroad laid down in the Vaddavaur District.— By* ———

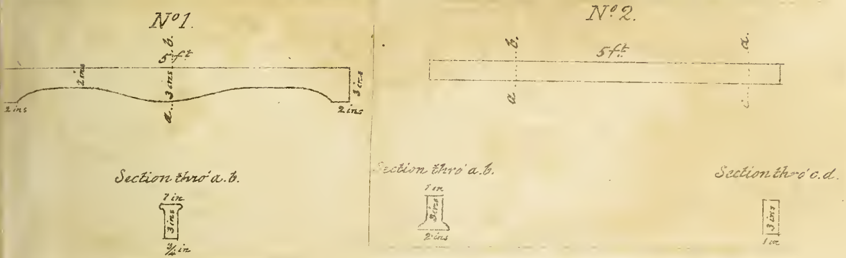
As the subject of railroads appears to be at present not altogether devoid of interest, I do myself the pleasure of forwarding you an account of a temporary roadway of this description laid down as a means of facilitating and expediting the transport of material pertaining to the Vaddavaur annicut, lately under course of construction across the river Colleroon.

A statement of the benefits or disadvantages which may have been derived from this mode of transport, together with a few observations, as to the expediency of employing such, as a general means of carriage, in the execution of all works of considerable extent throughout the country, may also perhaps not prove unacceptable. As these remarks, however, have been but hurriedly put together, it is hoped that their incomplete nature will be excused.

In the work in question a railway was not employed as a means of transit throughout its whole extent: in this paper, however, the results which accrued from the tract actually laid down, as well as what would have been produced, had a railroad been the only mode of transport, will be taken into consideration.

The total extent of rail actually laid, was four hundred and twenty-six yards, of this, two hundred and fifty were composed of cast iron, the remainder was made up of pieces of common bar-iron, varying in breadth from two to three and three quarter inches. The method adopted in placing these was their fixture in grooves, cut in portions of palmyrah trees, each portion forming a support for two rails. These supports, with the view of securing a stable foundation, were slightly bedded in the ground; the distance of one from the other was such as to admit of the extremity of each rail possessing a firm resting place. These extremities it was found unnecessary to join, so far as regarded the cast iron rail, as their weight and shortness secured a common level. With respect to the bar-iron, however, some mode of connection was requisite, as the length of the bar, and its comparative lightness, caused it to rise unequally on the application of heavy weights—the jointure was effected by a simple bolt. This method of laying down the road was found to answer well in every respect; a result the more satisfactory as entailing but a small portion of expenditure. The cost of one palmyrah tree may be reckoned at half a rupee, and this furnished supports for twenty-five feet of railway. This rate of payment will of course vary in different parts of the country, but it can never be very great.

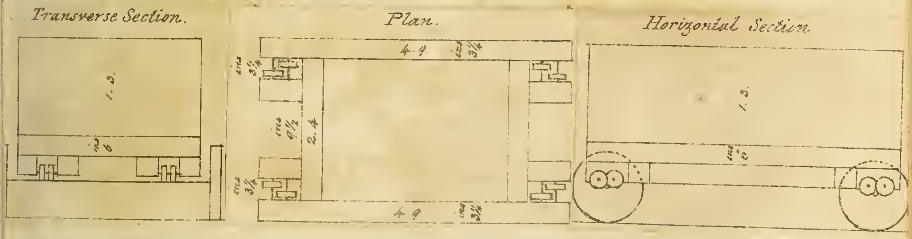
The cast iron rails were five feet in length; they were of two kinds, of which the following are plans and sections:



By experiments which these rails afforded, No. 1, a fish-bellied rail, weighing 35½ lbs., broke on the application of one thousand two hundred and seventy-four lbs. Its deflection, immediately before breaking, was three-eighths of an inch. No. 2, a parallel rail, beaded at the bottom, and weighing 37½ lbs. broke with one thousand eight hundred and forty-eight lbs. and bore a deflection of five-eighth of an inch. The difference of resisting power in each of these, as compared with the respective weights of composing material, will not fail to be at once perceived; this material was chiefly a mixture of Indian and English iron, cast in the foundery at Porto Novo, and sold at the rate of one hundred rupees per ton, including carriage.

The weight of a cart, of the nature made use of, bearing a full load, was one thousand five hundred and sixty pounds; this, being duly portioned over the rails on each side, left a weight to be borne by each, which was considerably below its breaking power.

The carriages which traversed this road were each worked by two men, and travelled at the average rate of fifteen miles per day; they were four in number, of which one was of capacity to carry nine hundred and forty-three lbs. of material, the remaining, seven hundred and thirty-two lbs. each. They were made up in the shape of boxes, placed upon a wooden frame, resting on axles, working upon friction-wheels, according to the following plan:



The wheels fixed on the axletrees were made of cast iron, and were one foot in diameter, possessing a circumscribing flange, projecting ¼ inch from the interior rim; the friction wheels possessed a diameter of 4¾ inches.

From the experience which was attained on this road, it is impossible to state the extent of advantage which will be derived from the substitution of these friction wheels, as a working place for the axles, in lieu of the common boxes; for the carriages employed were altogether of such rude construction, as not to hold out material for the formation of a fair judgment. Yet it may be useful to state, that, in order to overcome the inertia and friction of a carriage, whilst standing on the rails, a declivity of one in seventy was required, and also, that, although in constant use for two months, and travelling at the daily rate of fifteen miles, their axletrees were but very slightly worn. The following is an estimate of the expense of constructing one of this species of rail carriage:

		lbs.	R.	A.	P.
Iron tiring for	8 Friction wheels........	12			
	8 Axletrees for do........	12			
	16 Boxes for do........	21			
	2 Axles..................	42			
	Hooks and nails...........	12			
	4 Cast iron wheels........	240			
	Waste iron................	51			
	Total lbs.....	390	26	2	6
	Workmen-ship.				
	40 Smiths......................		15	0	0
	40 Bellows boys................		3	2	0
	13 Hammermen...................		2	0	6
	Charcoal and husk..............		3	12	0
	Price of wood.				
	Wood and planks................		5	0	0
	20 Carpenters..................		7	8	0
	2 Sawyers......................		0	12	0
	Total costs for one carriage, Rs.		63	5	0

The experience of a railroad, in this instance, certainly proves the expediency of adopting them as a mode of transport for material, in all works of considerable extent, both as a means of avoiding the confusion and misapplication of labour, generated by the employment of a large body of people, and also of its bearing the advantages of

economy. This latter cannot better be displayed, than by reducing the matter to the test of calculation, which will at first be shewn so far as regards the extent of railroad actually laid down, and then so far as carries with it the supposition that rails had been employed throughout the whole extent of operations.

1st.—The whole extent of railway laid down was, as has been before mentioned, 420 yards, the cost of which, together with the expense of carriage for 3 months, is as follows:

	R.	A.	P.
7 Tons, 2212 lbs. of iron at 100 rupees per ton.	798	12	0
Carriage for ditto	16	14	0
426 yards of wooden supports	25	1	0
5 Rail carriages, at 63 rupees 5 annas per carriage	316	9	0
900 Coolies, at 2 annas per day, at the rate of 2 coolies to each carriage	112	8	0
Total Rupees..	1,269	12	0

Expense, produced by carriage of the same extent of material, by animal labour.—

	R.	A.	P.
9,000 Bullocks at 2 annas per bullock	1,125	0	0

2d.—Probable expense produced, supposing that a railway had been used throughout the whole extent of operations.—

	R.	A.	P.
23 Tons, 21,561 lbs. of iron at 100 rupees per ton	2,396	4	0
Carriage for do. being at the rate of 15 annas per 1000 lbs.	50	2	0
1,278 yards of wooden supports	75	3	0
16 Rail carriages at the rate of 63 rupees and 5 annas per carriage	1,013	0	0
2,880 Coolies at the rate of 2 annas per cooly	360	0	0
Total Rupees..	3,894	9	0

Expense produced by the same carriage of material by animal labour, 29,992½ bullocks at the rate of 2 annas per bullock rupees 3,749—1—0.

By a cursory glance at these cases it may appear that the transport by rails, has entailed a greater expenditure than would have arisen, had animal labour been employed; but, in such a view of the matter, the actual cost of iron, which, by making use of the former method remains in hand after the work has been completed, is not taken into consideration. This material alone, as old iron, may be sold to those who originally furnished it, at the rate of 40 rupees per ton, thus reducing the actual expense considerably lower than the amount disbursed on animal labour. Moreover it stands undoubted, that every additional day, which

elapses during the progress of the work under execution, decreases rapidly the comparative expense of transport by means of railroads, when applied to such purposes as have just been stated. This cannot be better explained than by the fact, that if, in the last mentioned case, when rails are supposed to have been employed throughout the whole extent of operations, the work had been continued for six days more than what the calculation allows for, the laying of this road would have been the source of defraying the original cost, not only of itself but of the carriages which traversed it, the daily expenditure of transport by the rails being 16 rupees, that by animal labour 41 rupees, 4 annas.

Rails, also, when once obtained, are useful, not only for the work on account of which they have been immediately procured, but bear with them many advantages for the facilitating of future operations—As a source of economy in all works of considerable extent, as a means of warding off confusion and consequent misapplication of labour, where many workmen are engaged, their efficiency is undoubted.

XI.—Marava-Jathi Vernanam. — *From the unpublished Mackenzie Manuscripts in the possession of the Asiatic Department of the Madras Literary Society, &c.—Professor Wilson's Descriptive Catalogue, Vol. 1, A. II. No. 36.—Translated, with Introductory Observations, by the Rev. Wm. Taylor.*

INTRODUCTION.

The race of the *Maravas* have, at different times and in various proportions, been spread through the Tanjore, Madura and Tinnevelly provinces; but properly speaking they inhabit a strip of land on the coast, from Cape Comorin to some distance north of Ramnad, the principal town. They are a people of very considerable antiquity; and there appears to be some reason to conclude that they are descendants of the rude tribes that peopled the peninsula of India, before that *Hindùs* from the north had colonized it, and before *Bráhmanism* was therein known. It is a disadvantage to our earlier knowledge, that records have been written, and transmitted down to us, either by *Bráhmans*, or by persons under their influence. But, so far as can be ascertained, the peninsula, when first visited from Hindustan proper, was peopled by rude tribes of foresters, mountaineers, and hunters, uncivilized and uncontrolled. The expedition of *Rama*, the son of *Dasaratha*, of *Ayodhya* to the south, yields the first traces of history; though much disguised by the allegorical, the poetical, and the marvellous. According to the *Ramáyana*, the forest (or wilderness) of

Dandaca covered the whole extent of the southern peninsula; and the rude inhabitants are designated as *Rácshasas*, monsters; or *Vanaras*, monkeys. From considerable familiarity with the former term in extensive reading of *Hindù* productions, I feel grounded in stating that, though the idea it bears, poetically considered, is that of evil genii, or supernatural monsters, yet, being reduced to truth and simplicity, it denotes, in very frequent usage, races or tribes hostile to the genuine *Hindùs.* The other term I think to have been mistaken by the northern civilized *Hindùs* themselves: it denoted with them *monkeys;* but, as used by their bard *Valmica* for the tribes of the south, I imagine it designates the idea compounded of the word *vana*, a wilderness, and *nara* a man, that is, a wild or an uncivilized* man: and to this sense the fable of *Hanumàn* the chief monkey, and that of his army of monkeys, are, in my opinion, to be reduced. Those who have seen the *Collaries* and *Maravas* will readily consider them to differ from all family likeness of the *Hindùs*; and, as their visages often resemble baboons more than men, it would require even less than the ardent poetical imagination of a *Valmica* to induce the employment of an equivocal word, which would so aptly seem to convey the idea imparted by their appearance.

It would seem that, when *Rama* had succeeded in his war with *Rávana* on *Lanca*, or Ceylon, he appointed some special guardians from among the natives to be *custodes* of the idol, and temple, which he had constructed on the then peninsula, but now island, of Ramiseram. The word *Sethupathi*, of future frequent occurrence, means lord, or guardian, of the local peninsula. A *Telugu* manuscript, of the Mackenzie collection, states that seven† persons were appointed, from among the inhabitants of the Ramnad country, to be the guardians of the coasts, by the *Chacravertis*, or powerful *Hindù* sovereigns; a term quite indefinite, except that it designates only uncontaminated *Hindùs.* It is asserted, in an unpublished Mackenzie MS. entitled *Pándiya-rajákal*, that the *Maravas* became at one period so powerful and formidable, as to over-run the neighbouring *Pándiya* kingdom, to subjugate it, and to rule it for a considerable period of time. Though I once doubted the fact, yet this manuscript commands my assent. I regret that I did not meet with it in time to publish a translation of it, with other MSS. bearing on the history of that country; but it is not the only one claiming publication, and all may some day be printed toge-

* Professor Wilson, in his Sanscrit Dictionary, I observe has rendered the word by—"monkey, a *sylvan;*" and he speaks of it as compounded of *nara* a man, and the prefix *va* indicating *resemblance*, or, *like to a man.* Either way the equivocal meaning of the term is the same when applied to the wild races of the extreme south.

† Oriental Historical MSS. Appendix G.

ther. The circumstance however, so authenticated, comes in at a period when other already published manuscripts admit a period of confusion ; though pride, or love of country, might conceal so humiliating a fact, as that the feudatories of Madura had once been its lords and masters. Still this was a period when the *Pándiya* kingdom was in dispute by rival claimants, and in a state of civil war ; a period usually very convenient for neighbours to take advantage of : hence probably the temporary *Marava* supremacy.

It has been a custom, from very remote times, for pilgrims to visit the shrine at Ramiseram ; and the office of the local chiefs always was to conduct those pilgrims, or see them conducted, in safety, guaranteeing them, for a small acknowledgment, from the attacks of robbers among that lawless tribe, by which the country was peopled. In connexion with this circumstance, we find the first link in a regular historical chain; and this incident is not of more ancient date than A. D. 1500, or about that time. The chief spiritual guide of *Mutthu Kistnapa Naicker*, king of Madura, having occasion to visit Ramiseram, was safely and loyally conducted thither, and back again, by one of the seven chiefs, or guardians. Through the chief *Guru's* interest and recommendation, *Mutthu Kistnapa Naicker* invested the local chief formally with the title of *Sethupathi*, and with some other privileges ; among the rest with the right of building a fort. The *Sethupathi* subdued, and brought into order, other portions of the province, before anarchical ; carrying collections of revenue to Madura, and meeting there with great acceptance. The result of this policy at Madura, though very successful for a time, was ultimately to exalt one of the descendants of a before insignificant chief into a rival of the celebrated *Tirumalá-naicker*, the second son of *Mutthu Kistnapa Naicker*, and third from him in order of succession. The valour of *Tirumala-naicker's* general *Rámapaiyen* restored matters ; the rebel was taken on the island of Ramiseram, carried to Madura, and imprisoned in fetters. During his imprisonment the pilgrims suffered annoyance ; and, at their intercession, he was released, and re-instated. The good effects of this generous policy *Tirumala-naicker* afterwards experienced, in the *Sethupathi* being the chief instrument of repelling an invasion, of the Dindigul province, by the Mysoreans. As a reward the sovereign of Madura bestowed on the *Sethupathi* those distinguished honours, which are adverted to in the following document. At a later period also *Choka-natha Naicker*, a degenerate descendant from the Madura lords, was rescued from ignominious bondage to a rebellious favourite, by the conduct and valour of *Ragu-natha-dever*, more frequently styled *Kilaven Sethupathi* : a brave soldier, but unhappily a cruel man.

It will be perhaps superfluous here minutely to trace all the particulars of the history of this principality, seeing that they may be found

in Vol. 2 of Oriental Historical Manuscripts; to which I beg leave to refer. Suffice it to observe, as not therein so specifically mentioned, that the law of succession being very peculiar, and liable to be suspended, by trifling distinctions, arising out of the nature of marriage relations, the following manuscript is of so much the more consequence, from its illustrating those peculiarities.* Out of a family distinction, or arrangement, arose the division of the country between the ruler of Ramnad, and one of his relatives; the latter, by consent, coming into the possession of the town of *Sivagangai* and a connected district, very near to Madura, which the descendant of the so-styled *Udiyàn* still enjoys. The Ramnad succession was disputed and formed matter of appeal to the king in council; it being doubtful whether the award of the appeal was the correct one: a point on which there is no need to enlarge.

The following manuscript was evidently written at a time when the country was subject to the control of Mohammedan chiefs, or possibly even so late as when subject to the Nabob of Arcot; for it speaks of tribute imposed by *Amildars.* The writer of the manuscript being a *Hindù* seems to have been struck with those points wherein the *Maravas* differed from pure *Hindùs*; and chiefly fixed on the detail of these customs. His account evinces, when compared with Raffles' History of Java, that the *Maravas* are at least quite as much assimilated to the Javanese, as to the *Hindús.* It is of itself a topic of interest to find, at the extreme south, a race of people originally distinct from the *Hindùs*, and still materially so. In this respect they are relatively as the Welsh to the English; while, as to language, the case of the Normans who at length submitted to learn and use the Anglo-Saxon, modified and enlarged by their own tongue, is perhaps a nearer parallel. Sanscrit however, to which I allude, is much less influential on the colloquial speech, or written documents, of the extreme south, than among the natives here, on the northern confines of the usage of the Tamil language; and bordering on the Telugu districts, where Sanscrit, pure or derived, is still more copiously borrowed, and employed.

It remains perhaps only to state, that the style of the following manuscript is, in the original, loose; sometimes confused, or prolix. It is not the production of one accustomed to much writing; neither does the credit of great acuteness, or expansion of mind, belong to it. The chief point of its value is the exhibition of customs different from those of pure *Hindùs.* As such it may be of some interest; and may also be of use in some contemplated investigations, annunciation of which might, at present, be premature.

* Since the above was written I have met with a manuscript in the Mackenzie collection giving all the details of this transaction.

(TRANSLATION).

An account of the tribe of Maravas inhabiting the Ramnad, and Sivagangai, Districts.

There are seven subdivisions in the tribe of the *Maravas*, respectively denominated *Sembu-náttu, Kondaiyan Kottai, Apanur-nattu, Agat-thà, Oru-nattu, Upukatti*, and *Kurichikattu.* Among these subdivisions that of the *Sembu-nattu-Maravas* is the principal one. These four persons, that is to say, *Udiyat-dever*, of *Sivagangai*, *Kaimùthi-Udiyat-dever, Orurudiyat-dever, Papanam-pantal-udiyat-dever*, are relatives of the *Sethupathi ;* as father-in-law or brother-in-law, and are subordinate to the *Sethupathi's* authority. Among these four tribes the following subordinate classes are considered as branches ; that is to say, the *Pichakili, Marikakili* and the *Sittir-makili.* In these four tribes it is not permitted to intermarry with the mother's branch or class ; but they intermarry with those that are co-heirs, with themselves, of family property ; that is, with the children of their uncles, or the senior and junior brethren of their respective fathers. Except with these *Maravas*, this custom obtains not ; for other classes (of *Hindùs*) intermarry with the mother's relatives ; and are not allowed to marry with the immediate descendants of their fathers relatives. Among the *Sembu-nattu Maravas* it is the custom, of the family of *Sethupathi Udiyat-dever*, if the husband die, for the wife to enter the fire, or burn herself with the dead body of her husband. If the occasional occurrence of an exception to this practice be found, then the surviving wife is bound to remain all her life a widow and cannot marry again. However, in the case of the daughters only of the *Sethupathi*, and of *Udiyat-dever*, there is the peculiar custom, that if the husband die, or if the marriage prove mutually unacceptable (to the living parties) then the relatives and friends of both are assembled, who allow the female, in either case, to choose another husband who is acceptabble to her. Sometimes (in these two families) though rarely, the wife, on losing her first husband, has been known to ascend the funeral pile ; and in some cases a preference has been voluntarily given to remain in a state of widowhood.

The relatives of *Udiyat-dever*, the *Sivagangai* chief, are the following : *Sakanti-muttuku-marù-dever—Padamattur-Oyà-dever—Kattanur-tirukanat-dever—Arulikottai-Nallan-dever—Severkottai-periyudiyat-dever—Karkudi-kattanat-dever—Sembanur-raja-dever—Olakudi-muttukarupar-dever—Kovánúr-Buvulagat-dever*—these all are of the *Sivagangai* district. These reciprocally give and receive wives to and from each other, including *Udiyat-dever* of *Sivagangai*. The whole of them are of the class of *Sembu-nattu Maravas ;* they are also subordinate to the district ruler of *Sivagangai.*

These *Maravas*, and also those first mentioned, are by profession votaries of *Siva ;* notwithstanding they worship *Karupan, Bhadra-*

kali, Santana-karupan, Muttu-Karupan, Vira-bhadra, Sangili-karupan, Muni-esvaran, Ayyanar, Hariyavan, Samaiyan, Guru-nathan, Pathinettam-padi Karupan, Mathuraiviran : and to these various deities they make offerings of liquor, flesh, and fruits; praying to them according to the fashion of their own wishes. Then whenever the *pujaris* (persons officiating) are seized with the (evil) spirit, they utter replies announcing the (before not expressed) thoughts of the worshipping votaries, and declaring sometimes a prosperous, sometimes an unsuccessful, result. Among these *Maravas* many persons habitually make use of palm-wine and country arrack, as being the custom of the tribe; but a few refrain. Some of the men of the common classes among these *Maravas* are accustomed to lengthen the ear-lobes as long as a finger, and to put in them ear-rings; but the chiefs themselves never do so. Some persons wear ear-rings in the ordinary manner, (that is without lengthening the ears). Of the female *Maravas* some lengthen the ear-lobes to the extent of six or seven inches, and wear different kinds of jewels, distinctive of their class, or tribe. They wear very large garments, of twenty-five or thirty cubits in length, folded in plaits, and fastened behind. (Other natives, being *Hindùs*, do not exceed at the utmost twenty cubits; fastened on the right side in front). Some of the men use a small handkerchief worn on the head, others a white, or coloured, handkerchief of six or seven cubits: they never wear turbans. The rulers only, and that on special occasions, put on turbans, robes, and jewels, according to the customary fashions of the *Hindùs*.

The *Marava* chiefs, and also the heads of smaller districts were in earlier days, either simply proprietors of the villages, and of the right of the soil, or else they were merely guards of villages; but in process of time they became principal rulers, or chiefs of districts; and though possessing a long series of privileges and wealth as rulers, yet when poets write their panegyrics, or sing their praises, it is customary to style and entitle them only from the first small town, of which their ancestors were the possessers, or the guards. Besides these persons who are chiefs, of the other ordinary classes of the *Maravas*, not being subject to their authority, some are possessers, or guards, of villages; some are cultivators of the soil; and they appropriate the proceeds in part to gifts to idol-temples, in other part to house-repairs; and they pay tribute, according to the proportion demanded from them, by the *Amildars*, and other revenue officers.

The manner of their marriages is the following: whether the two parties be of the same or of two different villages, some of the man's relatives go to the dwelling of the bride and there while the *chank* (or conch-shell) is being blown, they tie on the *táli* (emblem of marriage); after which they bring her to the house of the bridegroom (who does

not go himself) : the immediate relatives with whom this office rests, are the sister of the bridegroom or else one of his aunts, accompanied by other relatives. On the bride being brought to the bridegroom's house, the relatives of both parties assemble there, and are feasted by the bridegroom with flesh-meat and other matters, to the extent of his ability, for one or two days ; when they are dismissed to their respective villages. Should it so happen either in the case of wealthy rulers of districts, or of poorer common people, that any impediment arises to prevent the complete celebration of the marriage with all attendant ceremonies according to the sacred books and customs of the tribe, then the *táli* only is sent and the female is brought to the house of the husband. At a subsequent period, even after two or three children have been born, the husband sends the usual *(Hindû,)* summons to a marriage of areca-nut and betel leaf; and, when the relatives are assembled, the bride and bridegroom are publicly seated in state under the marriage *pandal :* the want of completeness in the former contract is made up ; and all, needful ceremonies being gone through, they perform the public procession through the streets of the town ; when they break the cocoa-nut in the presence of *Vignesvara* (*Ganésa*) ; and, according to the means possessed by the parties, the celebration of the marriage is concluded in one day, or prolonged to two, three, or four, days. The *táli* before tied on, has the name of *katu-táli*, and the name of the last ceremony is called *the removal of the former deficiency*. If it so happen that after the first ceremony, the second be not performed, then the children of such an alliance are lightly regarded among the *Maravas*. Should the husband die during the continuance of the first relation, and before the second ceremony be performed, then the dead body of the man, and also the woman are placed upon the same seat, and the ceremonies of the second marriage, according to the customs of the tribe being gone through, the *táli* is taken off ; the woman is considered to be a widow, and can marry with some other man. These two customs of tying on the *táli*, and the consequent ceremony, are common to all the subdivisions of the *Maravas*.

The like usages also obtain among the class of people termed *Agambadiyar*. Besides, with the exceptions of the *Kallars* (collaries) of the *Tondamàn's* country, the *Kallars* of the *Visanga* district, and the *Kallars* of the eighteen *palliyams* (districts) connected with the Tanjore kingdom, all the tribes of the *Kallar* caste, throughout the Madura country, follow the preceding customs of the first and second marriage, in the aforesaid manner.

Among the *Maravas*, the kings or the rulers of districts, or principal men, are accustomed to perform the ceremony of tying on the *táli*, or in performing the marriage at once in full, with reference to females of

the *Agambadiyar* tribe. The female children of such marriages can intermarry with the *Maravas*, but not among the *Agambadiyar* tribe. On the other hand, the male offspring of such marriages, is considered to be of the mother's tribe, and can intermarry with the *Agambadiyas*, but not in the tribe of the *Maravas*. Among the whole of the *Maravas* the usual titular sirname is *Dever* (god). Among the *Agambadiyas*, the ordinary sirname is *Servikaren*. The titular sirname of all the *Kallars* is *Ambalakaren*. The tribes that pay outward respect to the authority of the *Sethupathi*, are the eighteen chiefs of the Tanjore country; *Udiyat-dever* the chief of *Sivagangai*; the *Tondaman* of *Puthu-Kotai* (or new fort): these testify towards him great veneration. The reason is because *Tirumala-naicker*, the sovereign of the Madura and Trichinopoly country, gave to the *Sethupathi*, the title of *Tirumala-Sethupathi;* bestowed on him the appropriate insignia of royal power; presented to him the lion-headed palanquin, in which he himself had been accustomed to be carried; called him his adopted son; invited him to eat of the cold rice of which he (the king) had before partaken; and conferred on him the title of *Sethupathi*. In consequence the aforesaid persons, from that time forwards, rendered to the *Sethupathi*, the respectful recognition due to a superior; (that is, standing before him, with the two palms of the hands joined together, and held in front of the breast). The following chiefs among the seventy-two Poligars of Madura, that is to say, the chiefs of Tinnevelly, *Cata-boma nayak* of *Panjalam-curuchi*, *Serumali-nayak* of *Cadal-cudai*, the *Tokal-var Dottiyas*, being all of inferior caste, fall prostrate before the *Sethupathi;* and afterwards are not allowed to be seated in his presence, but stand with their arms (respectfully) folded. The following chiefs pay the *Sethupathi* no exterior sign of respect or homage whatsoever; that is to say, the *Sillavas* and others of *Yettiyáburam*, the *Vadai-carei*, *Sokam-pattai*, *Uttu-malai*, *Settúru*, *Sarandai*, and other *Marava* chiefs; with the *Vanaiya* chiefs of *Siva-giri* of seven thousand fields, the *Talivan-Kotai*, and other *Vanaiya* chiefs. If they come before the *Sethupathi*, he rises in token of courtesy. When the *Sethupathi* goes out publicly, the criers (or heralds) proclaim him to be servant of the house of *Tirumala-naicker*, and invincible by the seventy-two chiefs (poligars) of Madura. Thus much is the narrative of the *Sethupathis*, and other *Maravas* of the *Sembu-nattu*.

The following is a circumstantial account of the *Maravas* of *Kóndian-Kottai*, and of the *Upu-Kottai Maravas*, who are heads of districts in the province of Tinnevelly. Among the *Upu-kottai Maravas* is *Vadagarai Senna-nancha deven;* among the *Kóndian-Kottai Maravas* are *Periya-sami-deven* of *Sakampati; Maruthapa-deven* of *Uttu-malai*, *Tiru-vanal-deven* of *Settur*, *Kadari-Saravat-deven* of *Surandi*, *Sethurayen* of *Singam-patti; Nalla-Kutti-deven* of *Urkádu*, *Sevel-puli-deven*

of *Ney Kútan*, *Arugu-dever* of *Kuruka-vatti*, *Muvaraiyan* of *Kodi-kulam*, *Tadiya-talavan* of *Cadambur*, *Indra Talavan* of *Maniyachi*, and the ruler of *Naduva-Kuruchi*. With the exception of the *Upu-kottai* chief, the other twelve are of the *Kóndian-kottai Maravas*. The customs of their tribe are the following. They do not make use of palm-wine-arrack; and though they eat flesh-meat, they yet bathe daily; and, putting on their silk* garments they then pay homage to *Siva*. They also make charitable presents or donations (to temples and the Brahmins). With the exception of the wives and daughters of the ruling chiefs, all their relatives follow this rule in the case of young women who being childless have lost their husbands, that is to say, the parents and principal persons among her relatives come and enquire whether, on account of her youth, it is her wish again to marry or otherwise: if she consent, another marriage is arranged; but if she do not consent, she remains a widow. In these things the customs of the *Upu-katai*, and *Kóndian-kottai Maravas* agree. The whole of the foregoing chiefs wear on their heads a handkerchief, either coloured or white, of seven or eight cubits, but do not wear turbans. They wear a body-cloth coloured, in the way called *Nir-kawi* (said to be the effect of constant washing every day) which is of eight cubits; but jackets, or vests, with long skirts are not worn by them.

Among the *Kóndian-kottai Maravas*, with the exceptions of the twelve before mentioned chiefs, and their people, others of that class reside in the Ramnad province, which is under the authority of the *Sethupathi*; and are in some cases possessors of villages, in others renters of villages, for a time: these also give a certain smaller proportion* than usual of tribute (*vari*) to the *Sethupathi*; they also appoint their own substitutes in the cultivation, and then hold official revenue situations under the *Sethupathi*. Those not so employed manage their own lands, and give tribute of the proceeds (*váram-varisai*), according to the ordinary custom.

The *Apanur-natta Maravas* follow the customs of the tribe, with the receiving and giving in marriage, the same as the *Kóndian-kottai Maravas*. Some among them are possessors of the villages; some of

* Or, *wet garments*. According to the notions of the *Hindus* garments if wetted, or silk garments, cannot convey defilement by the touch. For example, there are native physicians of the *Valluvar* (pariah) tribe: if they wish to feel the pulse of a person of caste, a silk garment is interposed between the point of contact. Two or three native doctors have had sufficient weight, by reason of their high reputation, to overcome this custom. In the case of a *Hindu* doctor (of caste) having to feel the pulse of a woman, in a case of ceremonial uncleanness, a silk garment is in likemanner interposed, in order to prevent contamination.

* The meaning seems to be, that these pay less in consideration of serving as clerks, or accountants, in the Cutcherry.

them temporary renters: half of them are manual cultivators, paying tribute to the government.

The customs of the tribe of *Agatá-Maravas* are the following: these are servants to the before mentioned *Dottiyas*, and this by hereditary descent. The men serve the men, and the women serve the women. The women of this tribe wear ornaments of red gum-lac, made to resemble coral. They imitate the females of the *Dottiya* tribe in the fashion of their ear-ornaments. The *Dottiya* men retain a portion of the *Agatà* women as a sort of inferior wives. The *Agatàs* are commonly called *earth-coral-wearing Maravas;* because they fabricate the semblance of jewels from gum-lac. If the husband of a woman of the *Agatà* tribe die, she again enters on the marriage state. These women are at liberty to take as many *successive* husbands as they please. This is the detail of the *Agatà Maravas.*

The following is the account of the *Curuchi Kattu Maravas.* The customs of this class resemble those of the before mentioned *Sembu-natta Maravas.* Although the females of the *Curuchi Kattu Maravas* intermarry with men of the *Sembu-natta Maravas,* yet the women of the latter class do not intermarry with the *Agatà Maravas;* and the male offspring of such marriages, intermarry only with women of the *Sembu-natta Maravas.* Though the *Curuchi Kattu Maravas* are *Saivas,* yet they perform *pujai* (worship) to various images as before specified. These people are all of them servants or laborers in cultivation, or small farmers, under the *Sethupathi.* Others are upon the footing of the *Sethupathi's* proper people; and pay tribute for their lands in the same manner. Such is the account of the *Curuchi Kattu Maravas.*

The following is the account of the *Orúrnattu Vattagai Maravas.* These are *Saivas;* but, as above, perform worship to various images. They are habituated to drunkenness. Like the before mentioned *Maravas* they are accustomed on the part of the bridegroom to give thirty* fanams as a marriage present to the bride, which is received by her father and mother. The elder or younger sister of the bridegroom goes to the house of the bride: and, to the sound of the conch-shell, ties on the *tali;* and early on the following morning brings her to the house of the bridegroom. After some time, occasionally three or four years, when there are indications of offspring, in the fourth or fifth month, the relatives of the pair assemble and perform the ceremony of *removing the deficiency;* placing the man and his wife on a seat in public, and having the sacrifice by fire and other matters conducted by the *Purohitan* (or *Brahman*); after which the relatives sprinkle *seshai* rice (or rice beaten out without any application of water) over the heads of the pair. The relatives are feasted and otherwise hospitably

* Most probably "cully fanams."

entertained: and these in return bestow donations on the pair, from one fanam to one pagoda. The marriage is then finished. Sometimes when money for expenses is wanting, this wedding ceremony is postponed till after the birth of two or three children. If the first husband die, another marriage is customary. Should it so happen that the husband, after the tying on of the *táli* in the first instance, dislikes the object of his former choice, then the people of their tribe are assembled; she is conducted back to her mother's house; sheep, oxen, eating-plate, with brass-cup, jewels, ornaments, and whatever else she may have brought with her from her mother's house are returned; and the *táli*, which was put on, is broken off and taken away. If the wife dislike the husband, then the money he paid, the expenses which he incurred in the wedding, the *táli* which he caused to be bound on her, are restored to him, and the woman taking whatsoever she brought with her, returns to her mother's house, and marries again, at her pleasure. This class of people belonging to the *Sivagangai* district, are soldiers of *Udiyat-dever*, those of them who live in the Ramnad district are soldiers of the *Sethupathi*. Those who carry spear and sword have land given them producing five *kalams* of rice; those bearing muskets seven *kalams;* those bearing the *sarboji*, nine *kalams;* those bearing the *sanjali* (or gun for two men) fourteen *kalams;* because of the two men, being double allowance. A *sirdar*, of one hundred men, has land equal to the produce of fifty *kalams;* half as much is apportioned to a chief of fifty men. These grants are made from various villages, and towns. In this way they derive the produce, paying tribute of five fanams for every *kalam* of rice; and in this way the cultivation is managed. Such is the account of the *Orurnátta-Maravas.* The like custom of military service is common to the other classes of the tribe of *Maravas.*

This is the completion of the illustration of the customs of the entire tribe of *Maravas.*

XII.—*Suggestions for the more careful Registry of Meteorological Observations; with a comparison of the Barometrical Results in Madras and Calcutta, and considerations regarding the influence of the wind on the Barometer.*—*By* T. G. TAYLOR, Esq. *H. E. I. C. Astronomer.*

The last ten years (it is remarked), have proved rich in the production of Meteorological Registers—such indeed is the case; and, but for one or two circumstances, the march of meteorology would have been proportionally rapid. In talking of meteorological registries, it is necessary, however, to be a little particular—we must draw a *broad* line of distinction between *that* register which is the *mere denoter of wind and weather*— which, trusting to the name of Troughton or Dollond, to give weight and accuracy to its results, leaves the rest to be guessed at—I say, we must draw a broad line of distinction between *such* a register, and one that is kept upon strict and scientific principles. That a great many meteorological registers belong to the former class, is a fact but too well known to those who have paid attention to, and compared the results of, the many, which, from time to time, have been published. In one we find 9 A. M., Noon, and 3 o'clock, prefered as the times of observation; in others the hours of 10 A. M. and 4 P. M. have a preference; at others again, the hour of noon alone is employed. But what is of far greater importance than this, is, the want of evidence that almost every Meteorological Journal carries with it of its character. When it is considered that the Royal Society of Great Britain failed, during two years, to make a perfect barometer, it will not be expected that the ordinary barometers that are supplied to individuals should be always perfect—hence the urgent necessity of comparing the barometer, in the first instance, with one of acknowledged merits, and of stating, in every registry, that it was compared on such day, with such a standard, and that the correction *(amount to be stated)* is necessary to reduce it to the Royal Society's standard: if in addition to this, any further evidence of this difference remaining unchanged can be adduced, so much the better— the Journal will be valuable to a proportionally greater amount. I am induced to make these remarks in consequence of having lately been occupied in comparing barometrical results: when, in India, I have only met with two registers, which, from their extent as well as accuracy, are likely to lead to satisfactory conclusions. These are the journal kept at the Assay-Office, Calcutta, and that kept at the Madras Observatory—these registers are made from instruments with which every possible pains has been taken, and the results can with confidence be relied upon. I was led to examine the barometrical observations of India, in consequence of certain results which have been

obtained in France; shewing that the direction of the wind influences the barometer: the results in question appear in the *Annuaire de le Bureau des Longitudes* for 1836—where, from 45 years observation, the following are arrived at :*

DIRECTION OF THE WIND.	BAROMETER.	
South............	Mean height—,133	inches.
South west......	—— —— —,118	„
West.............	—— —— —,024	„
North west.......	—— —— +,072	„
North............	—— —— +,100	„
North east........	—— —— +,111	„
East.............	—— —— +,055	„
South east........	—— —— —,066	„

In confirmation of these results, I may mention that from barometrical observations made during several years in England (the particulars of which I have not at present in my possession), I had noticed, that the barometer always stood higher, and had a tendency to rise, with a N. E. wind; and, on the contrary, always stood lower, or had a tendency to fall, with the S. or S.W. wind—hence it was desirable to know, if, during the periodical winds in India, the barometer exhibited a similar variation—for which purpose the following mean heights as set down in your Journal, have been reduced to the temperature of 32° and have been corrected for capillary action, and for the height (27 feet) so as to reduce them to the level of the sea.

Mean height of the Barometer at 10*h.* A. M. *as observed at the Honorable Company's Observatory.*

	1832	1833	1834	1835	Mean
January.....	30.143	30.163	30.078	30.090	30.118
February....	30.047	30.062	30.063	30.070	30.060
March......	29.998	30.005	30.008	30.016	30.007
April........	29.927	29.941	29.945	29.927	29.935
May.........	.810	.829	.844	.841	29.830
June.........	.745	.821	.791	.835	29.798
July.........	.762	.804	.784	.851	29.800
August......	.832	.888	.824	.845	29.847
September...	.873	.866	.875	.895	29.877
October.....	29.949	29.951	29.901	29.938	29.935
November...	30.088	30.044	30.075	30.071	30.070
December....	30.052	30.032	30.102	30.118	30.076

* These observations were made at Paris—from others made at *Marseilles* during a much shorter period, different results are obtained.

and further we have the following from the Register kept at the Assay Office in Calcutta, and published in the Journal of the Bengal Asiatic Society :

	1832	1833	1834	1835	Mean	Diff.
January	30.071	30.095	30.066	30.041	30.068	—,050
February.....	29.992	30.013	30.036	30.032	30.018	—,042
March......	29.921	29.904	29.934	29.965	29.928	—,079
April.......	29.814	29.809	29.845	29.918	29.847	—,088
May.........	29.716	29.661	29.663	29.727	29.692	—,139
June.........	29.573	29.613	29.574	29.605	29.591	—,207
July........	29.532	29.577	29.607	29.531	29.562	—,238
August......	29.522	29.643	29.593	29.635	29.598	—,249
September ..	29.713	29.696	29.722	29.746	29.719	—,153
October.....	29.898	29.904	29.880	29.870	29.888	—,047
November...	30.055	30.029	30.065	30.069	30.054	—,016
December....	30.045	30.058	30.091	30.082	30.069	—,007

A mere glance, at either of the above tables, shews us that a law of some sort does exist, which it is important should be investigated. We notice that the mean height of the barometer at 10 A. M. at the level of the sea, and at the temperature of 32° Fahrenheit, Inches.

	Inches.
at Madras..	= 29.946
Ditto at Calcutta, 29,835 + ,019*.....	= 29.854
Difference......	,092

We notice, further, that the barometer arrives at the maximum, both at Madras and Calcutta, about the middle of December, and at its minimum on or about the 1st of July. On inspecting the column " difference," which, it will be understood, is the difference between the Madras and Calcutta results, it is evident that some law, more or less simple, governs the two results, which it is likewise of importance to discover. The direction of the wind, and its consequences on the barometer, as given above, will evidently not reconcile the Madras results ; take for instance the month of December, when the N. E. wind prevails during 16 hours of the day, and the E. wind during the remaining 8 hours ; here we get

	Inches.	H.		Inches.
Cor. for E. wind =	+,055 ×	16 =	880 }	÷ 24 = +,074
— — N.E. — =	+,111 ×	8 =	888 }	

which correction being applied to the mean height, gives 30,020 for the barometer in December, differing from the actual observations ,093. With regard to the Calcutta results, I need hardly remark that they can in no wise be reconciled by the above corrections. I had proceeded thus far and was about to give up the matter, when it occurred

* This is to reduce the observations to the level of the sea.

to me that the dates "middle of December" and "1st July" were precisely those on which the earth arrived at its Perigee and Apogee with respect to the Sun : we will now see how far a formula $(1-R)\ x = h' - h$ will represent the observations ; where h represents the mean state of the barometer, and h' any other measure corresponding to R the radius vector of the Earth ;—forming the equations of conditions, x comes out 9,17, inches with which we can now compute the height of the barometer for any time, from the formula $h' = h + (1-R)\ x$, thus:—

MEAN HEIGHT OF THE BAROMETER, AT 10 A. M.

	From observation.	*From formula.*	*Difference.*
	Inches.	Inches.	Inches.
January	30.118	30.095	–,023
February....	30.060	30.056	—,004
March......	30.007	29.989	—.018
April.......	29.935	29.907	—,028
May........	29.831	29.840	+,009
June........	29.798	29.797	—,001
July........	29.800	29.796	—,004
August......	29.847	29.826	—,021
September...	29.877	29.903	+,026
October......	29.935	29.980	+,045
November ..	30.070	30.052	—,018
December....	30.076	30.094	+,018

Were it not that the month of October gives a difference so large in itself, and so much at variance with the following one for November, there would be little fault to be found with the formula. Since coming to this conclusion, however, I have examined all the barometrical observations made at Madras, during the last forty years, when, much to my surprize, the result for the month of October is nearly confirmed, but that for November is different—thus

	From 40 *years' observation.*	*From formula.*	
	Inches.	Inches.	Diff.
October......	29.966	29.980	+.034
November...	30.005	30.052	+.047

If these two differences be substituted for those set down in the above table, a much greater degree of consistency is produced, although the differences are larger. That the mean state of the barometer, resulting from four years' observation, should differ to the amount ,065 from the general mean, would point out, that, during the month of November in each of those four years, some considerable atmospheric derangement must have existed ; that such has actually been the case, is well known ; for, on consulting the depth to which rain has fallen in November, we find the average of 40 years = 14.13 inches
in 1832-33-34 and 35 .... = 7.54 "

But, to return to our subject—It appears that the formula exhibits the state of the barometer throughout the year to as great an accuracy as it can be observed, with the exception of the months of October and November :—now these months are particularly distinguished for the dense state of the clouds, and the large quantity of rain (about 26 inches) which usually falls, circumstances which, one would suppose, would be more than sufficient to account for four or five hundredths of an inch of the barometer. In addition to the above, I have endeavoured to account for the changes of the barometer, by allowing its variations to be expressed by some function of the temperature, of the Sun's declination, and of the altitude; but nothing like a reconciliation can in any way be produced. On inspecting the Calcutta results it is evident that our formula is altogether insufficient to express the variations there met with ; but it is equally evident that one of a similar nature is necessary ; instituting accordingly the formula $h' = h + (1-R)\ x'$, and solving the equations of conditions which thence arise, we get $x' = 13.67$ inches, which being substituted in the formula, we get

THE MEAN HEIGHT OF THE BAROMETER AT CALCUTTA, AT 10 A. M.

	From observation.	*From the formula.* Inches.	*Difference.*
January.....	30.050	30.077	+,027
February....	30.018	30.018	,000
March......	29.928	29.917	—,011
April........	847	.848	+,001
May........	692	.695	+,003
June........	591	.633	+,042
July.........	562	.630	+,068
August......	598	.686	+,088
September ..	719	.790	+,071
October.....	29.888	29.905	+,017
November ..	30.054	30.013	—,041
December...	30.069	30.074	+,005

Here the formula agrees well for the first five months of the year;—in June, July, August, and September, (the months in which heavy rains fall—the monsoon in fact) we find, as in the case of the Madras Register, that the formula gives too large a result. For October (which is a fine month in Calcutta) the formula agrees well—for November I suspect the observations (which it must be recollected are derived from four years observation only) are a little too large, probably ,020; in which case the formula appears to belong, as well to the Calcutta, as to the Madras results. I have already stated that there are no further results to be met with from observations in India, which are suited to this our

purpose; but the Calcutta Journal for August 1833, gives the result of six years' observations made at Singapùr, by Captain C. E. Davis, as follows :—

MEAN HEIGHT AT 6 A. M.

January......	29.947	July	.908
February......	.938	August........	.895
March	.920	September.....	.918
April.........	.920	October.......	.912
May..........	.897	November	.913
June..........	.890	December.....	.932

Here too (it is almost needless to observe) the variations of the barometer can be accounted for by a formula, similar to that employed in Calcutta and Madras, save that the value of x will necessarily be very small. That this formula should agree thus well with three independent registers, renders it highly probable, that the distance of the Earth from the Sun does, under certain circumstances, affect the state of the barometer. Now the influence of the Sun upon the Earth on the first of January, is to its influence on the first of July (by reason of its relative distances at those times) as 1032 : 968; the effect of which is to create a tide, or to produce a higher state of the barometer, in January, than in July—the *circumstances* to which we allude are, the nature of the situation, with regard to its proximity to continents or seas, and its latitude.

In the middle of a continent, or large island, for instance, we should expect a very different result from that of a place situated upon the sea coast, or from that of a small island; and a further considerable allowance (due to the latitude) would probably be necessary for the obliquity under which the Sun's rays enter the atmosphere at any place. Leaving this last cause out of the question, as being likely to interfere but little with the three cases under consideration, we find the location of Singapùr to be insular, or to differ but little from that of a spot in the middle of the ocean; we, consequently, should only expect a small amount of correction : whereas at Calcutta (which is surrounded by land) we should expect the largest amount of correction; and at Madras (which is situated upon the coast) a correction of medium amount, only, should be expected. Now although these expectations are borne out by the results before obtained, still it would be rash, in this early stage of the enquiry, and upon so few results, to entertain any opinion beyond a suspicion. Under these circumstances, it only remains for me to apologize for this intrusion, when so ill equipped; and to explain that my only motive for so doing, is to shew how important it is, to be exact in barometrical measures, and, by exhibiting how deficient we are in meteorological materials, to attract a further attention to the subject.

XIII.—*On the Position of Frames in a Sloping Gallery.*

TO THE EDITOR OF THE MADRAS LITERARY JOURNAL.

SIR,

I am much obliged to you for sending my former letter to your correspondent A MINER, and to him for correcting the errors I complained of. I wish though he would again refer to my letter and see if *I did* assert that P is greatest when B C is greatest: no, I only quoted his own proportionals, and endeavoured (with what success you and your readers will judge) to prove that he made a wrong deduction from them. He asks me what I think of No. 2? I must say it is not so satisfactory to me as it is to him. He divides the force of gravity into two parts, one parallel, the other perpendicular, to the plane; the latter, he lays hold of to prove his argument upon, and the former is totally set aside. Now suppose Sir Isaac Newton, or some other Mathematician, were going down a steep hill in his palankeen, and were to divide the force of gravity on A MINER's theory, and to tell his bearers to place themselves in a position perpendicular to the slope; his bearers would look anxiously for the sturdy bough of a tree, or some other friend in need, to relieve them of the responsibility of the parallel portion of Sahib's sub-divided gravity, confident enough, perhaps, without the aid of Mathematics, that they could take upon themselves the perpendicular portion, but until they get to the tree or meet with some other friendly aid, they would have to keep the erect position—And is it not so in driving a sloping gallery? My next objection to No. 2, is this. A MINER says " then by proposition of the lever A G; $c\,w = F.\ x.\ A\,E$, or $b\,c\,w = a\,F\,x$."

What the lever has to do with the question, I cannot make out, so I leave it to the more learned, but take his equation.... $c\,w = F.\ x.\ A\,E$; and as he assumes $AE = a$, substitute a for AE and we have $c\,w = a\,F\,x$—how then can he make $b\,c\,w = a\,F\,x$?

I have been talking the question over with my friend " A BORER," and I have persuaded him to write to you on the subject, which perhaps may serve to keep the matter alive, if you will be so kind as to give his letter a place in your Journal.

I am quite sure *you* do not look upon my humble efforts to draw truth out of a mist, as bearing sweeping censure in their train; " A MINER" does himself great injustice, and will, I hope, excuse the free, but unlearned, remarks of

A WOULD-BE MATHEMATICIAN.

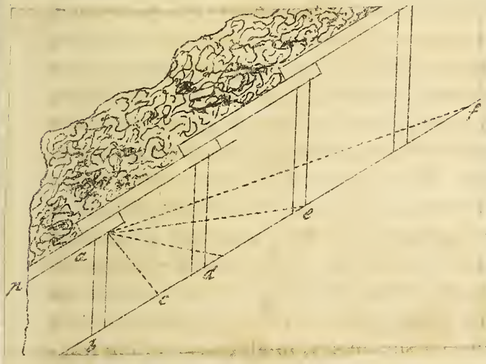
TO THE EDITOR OF THE MADRAS LITERARY JOURNAL.

SIR,

You invite remarks on the subject of the position of frames in a sloping gallery. I beg to offer the following.

The first thing to be considered is what the frame is required to support: it can scarcely be said to be the whole mass above the excavation, for all soils have more or less support derived from their own adhesion, or the counterpressure of the neighbouring parts. Some soils require no support, others (such as those from which only massive fragments can detach themselves) may be supported by simple props, and these must be placed vertically, unless the fragment can, by an oblique prop, be brought to bear a portion of its weight upon a more solid body; but I suppose here, soil of uncertain nature, and every fragment calling for distinct support, to show an instance in which vertical props *must* be used. I will now proceed to consider the case to which your correspondents appear to refer, namely, where the soil is of such a nature as to require frames and sheeting planks—now, what is the force exerted which the frames have to resist? I should say, in all cases, falling fragments detached by the force of gravity from the mass above, variable according to the nature of the soil, but exerting a vertical force. In ordinary soil these fragments fall on the sheeting, striking a blow which in some measure acts obliquely on the head of the frames if vertical, on the principle that a plane, struck by a force in any direction, is only affected in a direction perpendicular to itself. But, to fulfil this principle the blow must be such as is struck by a ball, which glances; for, if the ball penetrates, the force communicated to the plane, is in the direction of the stroke. If the soil is moist and adhesive, it at once unites with the sheeting, and acts only with a vertical force on the supports; if loose and dry, it falls on the plane and slides down, in some degree acting as a stroke, but its effect will be somewhere between that of the ball which penetrates and the ball which glances, between a vertical direction and a direction perpendicular to the plane. If the particles are light, the effect in the latter direction must be wholly insignificant, yet this is the only way in which I can account for the tendency to fall backwards, which vertical frames in a sloping gallery are found to have; for, when the fragments cease to fall, and become settled on the sheeting, they form one mass acting with the direct force of gravity. Unless we take altogether another view of the subject, and show that practically a vertical support, to a sloping surface, is likely to slip from under it and not act at all; but this has nothing to do with the principle, for if it acts at all; that is, if there is friction enough to prevent its slipping, it acts the same as if a notch or step were cut for it, and directly opposes the vertical pressure. It would, therefore, appear that a trifling obliquity is necessary, when the frames are first set up, but this *neces-*

sity ceases when the earth has accumulated and settled on the sheeting. The frames however in this way now support the whole weight, and the question is whether they may not be relieved of a portion of the weight by giving them an oblique position, and if so, what is the position in which they will have least strain upon them.



In the annexed figure I have endeavoured to represent the loose earth acting on the sheeting, and which with the sheeting itself, forms the mass to be supported. If the frames are placed as *a b* vertically, they can have no tendency to fall backwards or forwards when the particles have ceased to fall, because they have to resist only a dead vertical pressure. But suppose them placed as *a c* perpendicular to the gallery: here the force of gravity is divided into the two forces, one parallel, and the other perpendicular to the inclination of the gallery; and, supposing the sheeting to be securely supported at *p*, the weight, actually sustained by the frame, is reduced in the proportion of *a b* to *a c*; for in the triangle *a b c*, if the total vertical pressure be represented by *a b*, the pressure on the frame will be as *a c*, and that on the point *p* as *c b*; and it is evident that when *a c* is perpendicular to *c b*, as in this case, it is a minimum, and bears the least possible strain. For this reason, and because the frame has the advantage of being shorter, and has no tendency to slip at the head or foot, and as it seems undeniable that some obliquity from the vertical position is necessary at first, this position has been adopted on a general rule.

In ordinary galleries no great inclination is required; it is easier and more convenient to sink a shaft, and carry a level, or slightly inclined gallery, to the point required, but for the sake of a general view of the subject, if I am not trespassing too much on your pages, let us see how this position would answer in a gallery of great slope.

When the gallery is completed, the sheeting rests securely on the solid earth at *p*, and if a sufficient quantity of loose earth has fallen, so as to prevent any one plank from sliding over that next below, the frames placed as *a c* will be secure, but if the gallery is to be carried on, the support at *p* is for the moment removed by the miner, and the whole mass supported, has a tendency to fall forwards: this I should think a sufficient difficulty to show itself even in galleries of no very great inclination, though a little management may prevent any ill effects; but,

in a steep gallery, sufficient to set aside the application of the general rule; and if in such a case the frames were placed only so much out of the vertical position, as to resist the effect of the first falling of the fragments, I should conceive it a better position than if perpendicular to the inclination of the gallery.

When the perpendicular position can be resorted to, as there is less weight on the frame, and the frame is shorter, the scantling may be less, which is a saving of timber, and the frames are lighter and more convenient for use, so that I am far from objecting to the rule, but cases may occur in which it would be found to fail, and I merely offer these remarks for the consideration of such as take an interest in the subject.

I am tempted to try your patience a little further by a comparison of the pressure exerted on the frame, with that thrown upon the point *p*. Let *a d*, *a e*, *a f* represent other positions of the frame; *a e* being supposed horizontal. It will be found that the pressure on the frame is to the pressure on *p*, universally, as the secant of the angle of elevation or depression of the frame is to the secant of the angle of inclination of the gallery. For, in any position of the frame, as *a d*, the force on *a d* is to the force on *p*, in the direction *a p*, as *a d* to *d b*, or as the sines of their opposite angles, thus:

Force on *a d* : force on *a p* : : *a d* : *d b* : : *sine* ∠ *a b d* : *sine* ∠ *d a b*; but the sines of these angles are equal to the cosines of the angles of elevation (or depression) of the frame and gallery. ∴ Force on *a d* : Force on *a p* : : cosine elevation (or depression) gallery : cosine elevation (or depression) frame, and as cosines are reciprocally as secants of the same arcs or angles, we have force on *a d* : force on *a p* : : secant elevation (or depression) frame : secant elevation (or depression) gallery. In the vertical position of the frame, as *a b*, the secant being infinite, the frame bears the whole weight, and there is no pressure on the point *p*. If the frame slopes at an angle equal with that of the gallery as *a d*, the secants being equal, the pressure is equal on each. In the horizontal position, as *a e*, the secant becomes equal to radius, which is the least possible, and here the frame has the least possible pressure compared with that at the same time acting on the point *p*, and the same rule holds good when the frame comes into the position *a f*, where the secant of the angle of depression is again greater than radius, and the frame is charged with a greater relative pressure than when horizontal; and so on, until it comes infinitely near to the same inclination as the gallery, when the secants are again equal and the pressures also, but at the same time their power to sustain a vertical force at *a* ceases, as two equal and opposite forces can have no effect but to neutralize each other, and all support is withdrawn.

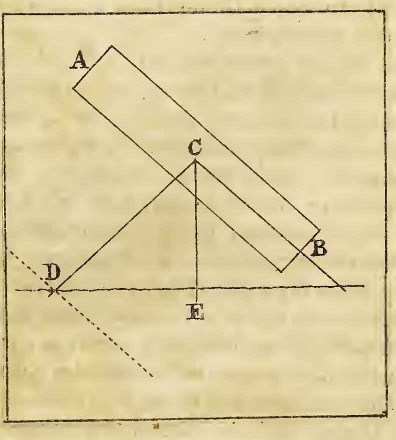
Your obedient servant,

A. Borer.

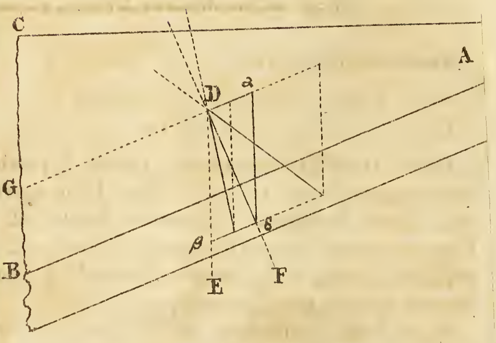
To the Editor of the Madras Journal of Literature and Science.

Sir,

At page 335 of vol. 2, a solution of the problem of the proper position of a prop upon an inclined plane is given, but, it is to be remarked, the axiom on which the first solution is attempted, does not apply to the subject in question; in all cases of equilibrium where the two forces do not act in the same line, there being a third force to be accounted for, which is there neglected, nor is the reasoning in application of the principle correct, vide diagram, page 336, vol. 2. If the direction of the power is taken in the line D C, the line B A must also be made perpendicular to it, which is not done. The propriety of placing a prop perpendicular to the direction of the mine, can, I think, hardly be denied, when the subject is properly considered. Suppose A B to represent a mass of stone, to be supported in an inclined position, would not the prop naturally be placed in the direction D C, and while the stone was supported by a firm support at B, would not the prop be placed in the same position, even if the ground was sloping? Here the force of gravity is acting in the direction C E, but becomes resolved into two other forces, C B and C D, to oppose which, the prop is placed in the direction of its action, which, it is hardly necessary to prove here, would be its best posi-



tion. Again let A B, be the direction of the mine carried in as far as B—A C the surface of the earth. It is evident that if the roof of the mine was unsupported, the portion A C, would fall in. Let D be the centre of gravity of this mass, which is conceived to act as a solid body, as the roofing along the top of the mine brings it exactly into the situation of a box of sand. D E will then be the direction of the force of gravity; now it is very evident that a prop, placed upright in the line D E, would bear all the weight of the mass, and that cannot therefore be the best position, but if the prop is placed in the direction D F, the force D E becomes resolved into two others, D F and D G, parallel to the direction of the mine, for as the mass cannot now move in the direction D F, it can only move at right angles to it. Produce D G to a and make D a equal to the force exerted in that direction, also in D F, take D β equal to the force of gravity make β δ parallel to D a and equal to it, and complete the parallelogram of the resolution of forces, then will D δ represent the force exerted in the direction D F of the prop, and which from an inspection of the diagram, will be a minimum when the angle D δ β is a right angle; the force D a decreasing as the angle δ D β decreases, and increasing with its increase, while D δ increases in both cases, D β always remaining constant. The pressure on the prop will then be least, when perpendicular to the direction of the mine, and the weight supported by it, decreasing as the cosine of the angle F D E = C A B = the angle of the depression of the mine.



Yours obediently, C.

27th September, 1836.

XIV.—*On a New Genus of Scrophularineæ.—By* William Griffith, Esq. *of the Madras Medical Establishment.*

Synphyllium.—*Mihi.*

Syst. Linn.—Diandria Monogynia.

Ord. Nat.—Scrophularineæ.

Char. Gen.—*Calyx* planus, *sepala* 4, postico maximo, lateralibus minoribus obtectis. *Corolla* ringens, labio superiore emarginato, inferiore trilobo bi-cristato. *Stamina* fertilia 2. *Stigma* bilamellatum. *Capsula* calyce ampliato obtecta, bilocularis, bivalvis, valvis integris margine planis, dissepimento parallelo placentifero demum libero. *Semina* foveolis (6—7) exsculpta.

Herba basi decumbens. *Folia* opposita dentata. *Racemi* terminales vel pseudo-axillares. *Pedicelli* ancipites.

Obs.—Genus, ut videtur, distinctissimum habitu Toreniæ, calyce fere *Herpestidis,* corollâ *Vandelliæ* staminibusque *Bonnáyæ,* notuque dignum ob sepalorum anticorum coalitionem.

Synphyllium *Torenioides*—Hab. In sylvis prope Suddiya regionis Assamicæ Superioris.

Descr. *Herba* pedalis bipedalisve basi decumbens. *Caulis* 4-gonus, articulis valde incrassatis, sanguineo-purpureis, puberulus. *Folia* opposita, longiuscule petiolata, ovato-lanceolata, basi sæpius obliqua, in petiolum sub-attenuata, obtusa, irregulariter crenato-dentata, supra læte viridia tactu retrorsum scabra et sub lentem punctulata, subtus pallida, utrinque, sed præsertim subtus, ad venas puberula, venis secondariis distinctis prædita. *Petioli* unciales, supra plano-canaliculati, medium infra purpurascentes.

Racemi pseudo-axillares vero terminales, tetragoni, angulis acutis marginatis, scabrelli, ad anthesin folia longitudine vix æquantes, demum excedentes. *Pedicelli* sub-oppositi, ancipites marginati fere alati, sursum latiores, patentissimi. *Bracteæ* foliaceæ, lanceolato-lineares, pedicellis triplo breviores.

Calyx tetrasepalus; planissimus ; sepalo-postico maximo, foliaceo, cordato-ovato, integro, basi sub-biauriculato, venoso, venarum apicibus arcuatim nexis; antico subsimili minore, basi ovato, apice emarginato vel bifido (etiam bi-partito) venis magis reticulatis; 2 lateralibus minimis obtectis linearibus, carinatis, scabrellis. *Corolla* ringens, calyce paullo longior ; tubus intus villosiusculus, basi ventricosus ; labium superius fornicatum, parvum, apice erecto emarginato, fuscum vel rubro-fuscum, inferius trilobum, lobis rotundalis marginibus inflexis, intermedi minimo, bi-cristatum, cristis pubescentibus, utrâque desinente in corpore (stamine sterili) breviter stipitato, clavato-rotundato, glanduloso, flavo. *Stamina* 2 fertilia (superiora) inclusa. *Filamenta* glabra breviuscula. *Antheræ* approximatæ, biloculares, loculis diva-

ricatis, apice sub-contiguis, longitudinaliter dehiscentibus, albis. *Connectivum* dilatatum ad dorsum loculi superioris 1-dentatum. *Pollen* ovale, tri-sulcatum, album, in aquâ submersum sub lentem, centies augentem obscure granulosum. *Glandula* hypogyna carnosa, albida, subintegra, postice incompleta, ad basin ovarii adest.

Ovarium conico-ovatum, glabrum, biloculare. *Ovula* 00 adscendentia, galeæformia, simplicia (an e cohesione?); situs foraminis hilum prope; facies *raphalis* infera quoad axin. *Stylus* filiformi-clavatus, glaber, vasorum fasciculis duobus instructus. *Stigma* bilamellatum, lamellis approximatis fimbriatim denticulatis, postico vel superiore minori. *Capsula* late-ovata, venosa, compressa, stylo stigmateque sphacelatis terminata, basi glandula semicincta, marginibus undulatis, calyce ampliato clauso planiusculo obtecta, bilocularis, bivalvis, valvis integris submembranaceis, concavis, margine simplicibus flexuosis subinvolutis. *Placenta* demum libera, valvis parallela, septis apice distinctis adnata. *Semina* 00 minuta, rotundata, depressa, pallide brunnea, foveolis 6-7 lateralibus profundis exsculpta, inconspicue reticutata, papillis albis lineatim dispositis scabrella, funiculo brevi atrato insidentia. *Raphe semi-completa*, linearis, angusta. *Chalaza* punctum apiculatum, atratum, submammillæ-forme. *Testa* tenuissima, areolata, alba. *Tegumentum* interius coriaceum, brunnescens, albumini firme adherens—*Albumen* densum, carnosum, album, foveolis totidem exsculptum—*Embryo* orthotropus, axilis. *Cotyledones* minimæ, plano-convexiusculæ. *Radicula* longiuscula, subcylindracea. *Plumula* inconspicua.

I may take this opportunity of adverting to a Synopsis of the East Indian *Scrophularineæ*, by Mr. Bentham, in which great progress has been made towards extricating these plants, which form so conspicuous a portion of our flora, from the confusion in which they were left by Roxburgh, whose characters are so short as to be frequently entirely useless. The Synopsis is prefaced by an introduction, in which may be found much valuable information. In this I shall only notice two points, which appear to me not quite correct.

The first regards *Verbenaceæ*, which are stated to have an ovarium divided into unioculalar cells. This, however, is by no means the general character of the order, which is to have a bilocular ovarium, each cell containing two ovula, erect or pendulous, and becoming sometimes bilocular by the growth of the placentæ outwards between the ovula. A contrary modification to this exists in some, and especially in those genera, as *Congea* of Roxburgh which are characterized by having capitulate flowers surrounded by an involucrum. In these the ovarium is unilocular and the placentæ free, resembling very closely those of *Santalum* and *Olax*. To this section, which is of common occurrence in the Flora of Mergui, *Avicennia* comes very

near, agreeing entirely in placentation, direction of the ovula and situation of the foramen.

The second is of more importance. In speaking of the distinction between *Primulaceæ* and certain genera of *Scrophularineæ*, Mr. Bentham remarks, in reference to the stamina of the two orders belonging to different series, that in *Scrophularineæ* no trace of the inner series, that which is alone developed in *Primulaceæ*, has as yet been observed, unless "the deeply cleft disk, described by Martius as encircling the ovarium in *Herpestes lanigera*, or the scales in the tube of the corolla of *Artanema* be considered as abortive stamina." Without having any knowledge of *Herpestes lanigera* or *Artanema*, there can I think be no doubt that the disk of the former is merely a development in excess of the glandular disk, so common and nearly universal in the order, and which, according to its completion or incompletion, I take to represent the whole or part of the inner series of stamina. This disk frequently presents traces of division; the divisions, although obscure, then corresponding to, or being opposed to, the component parts of the corolla. When incomplete, the deficiency, so far as I know at present, appears always to take place posticously. Hence, as in most diandrous genera of this order, the upper stamina are alone developed, the direction of the development of the two series appears to be, as indeed might be expected, reversed. The remainder of my observations will be confined to the tribe *Gratioleæ* of the same Synopsis.

Of the genus *Mimulus* Upper Assam affords one species, which appears to be new, and which may be thus characterized :—

Mimulus *Assamicus, Mihi:* diffusus subglaber, foliis obovatis vel ovatis basu versus integris cæterum argute dentalis penniveniis superioribus sessilibus, calycibus campanulato-tubulosis truncatis dentibus brevibus subequalibus, fructiferis amplis subinflatis.

Hab. Ad ripas arenosas fluminis Burrumpootur, regionis Assamicæ Superioris.

Herba pusilla basi radicans. *Folia* inferiora obovata, reliqua ovata et basi attenuata, vel obovato-lanceolata, dentibus mucronatis. *Flores* oppositi, parvi, lutei, tubo intus rubro guttato. *Pedicelli* filiformes demum folia excedentes. *Antheræ* basi celluloso-papillosæ. *Glandula* hypogyna nulla. *Placentæ* stipitatæ. *Semina* pallide brunnescentia, oblonga, sæpius pilis brevibus hyalinis apice 2—4—uncinatis hispida.

E charactere proximus videtur *M. Nepalensi* Benth. Scrophul. Indicæ p. 29. An satis distinctus ?

Of the genus *Herpestes*, one curious species was found by Dr. Wallich and myself at Jumalpore, singular in the great development of the calyx and in the unilocularity of the ovarium, depending upon the

placentæ, which are large and fleshy, and bear ovula on every part of their surfaces, not meeting in the centre. To this plant, which has not the usual habit of Herpestes, w e gave the MSS. name of *Cardiolophus decussatus;* but I am not sure whether the above structure of the ovarium is of generic importance. Its occurrence, however, although in this perhaps solitary instance, weakens the distinction between this order and *Cyrthandraceæ.*

The characters of *Microcarpæa* and *Peplidium,* as given by Mr. Bentham, seem to me to admit some doubt. In one species in my possession, certainly referable to *Microcarpæa* as characterized in Mr. Brown's Prodromus, but which, as I have not seen ripe fruit, I am unable to refer positively either to the same genus or to *Peplidium* of the Synopsis, the developed stamina correspond to the lower pair of the didynamous genera of the order, and in addition the anthers are unilocular.

The abortion of the lower pair of stamina of *Bonnaya* appears to be constant; and it is by this at once distinguished from *Vandellia.* This latter genus passes into *Torenia;* one species, which I refer to *Vandellia pedunculata* (Scroph. Ind. p. 37) having the corolla of the former, wanting the fornicate upper lip, which appears to me to characterize the true species of the latter. The only constant distinctive character of *Torenia,* at least as regards *Vandellia,* consists in the plicate calyx; and, as regards *Mimulus* and *Uvedalia,* in the dehiscence of the capsule, and perhaps the structure of the seeds. I am acquainted with one species, which agrees in every other respect with *Torenia,* but the lower pair of filaments are entirely simple. This I propose to characterize thus:

Torenia *edentula'—mihi,* erectiuscula molliter hirsuta, foliis petiolatis cordato-ovatis rugosulis floribus pseudo-axillaribus fasciculatis racemosisque, filamentis longioribus basi edentulis.

Hab. Circa Suddiya, regionis Assamicæ Superioris.

Corolla calyce vix duplo longior, sæpius cæruleo pallide tincta, lobis lateralibus labii inferioris partim saturate azureis, medio macula lutea notato.

The flowers of both *Vandellia* and *Torenia* are described by Mr. Bentham as axillary; the infloresence is, however, in both terminal, especially of those species which have fasciculate flowers. It appears axillary only, when one of the axils alone of the two terminal leaves, gives origin to a branch, which, as in many other instances, has the appearance of being the true continuation of the axis.

I am inclined to think that good additional distinctive marks may be drawn from the seeds. *Synphillium, Bonnaya, Vandellia* and *Torenia* agree in having foveolate seeds; these foveoli vary in number in the different species; they are least numerous and nearly definite in *Synphyllium;* much more numerous in the species of the three other

BRITISH MUSEUM
NATURAL HISTORY

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genera, I have hitherto been able to examine, in all of which they are arranged in single rows. They arise from the inflection of the inner membrane into the albumen, with which it firmly adheres. The testa, which in all the above is very thin and areolate, is inflected into the cavities only in the dry state, and then gives to their fundi a cellular appearance. Immersion in water causes the inflected portions to regain, or even to project beyond, the level of the more elevated portions of the surface of the seed.

EXPLANATION OF THE FIGURES.

1. Flower—back view.
2. Do. front view.
3. Corolla, viewed laterally.
4. Do. laid open.
5. Anther—front view.
6. Do. back view.
7. Pollen—in the dry state.
8. Do. immersed in water.
9. Pistillum—posticous sepal partly removed, anticous one cut away, except at its base which is deflexed.
10. Ovarium—transverse section.
11. Ovulum.
12. Stigma.
13. Capsule.
14. The same after dehiscence.
15. Seed—viewed on its raptal face.
16. Do. longitudinal section.
17. Do. transverse section.
18. Embryo.

XV.—*A brief notice of some of the Persian Poets.—By Lieut.* T. J. NEWBOLD, *of the 23d Regiment Light Infantry,* Aid-de-Camp *to Brigadier General* WILSON, C. B.

(*Continued* from Vol. III. P. 47.)

Fiazi Faizi.

فياضي فيضي

Mention is made of this poet in the *Zumret-al-Ulema,* as being endowed with "many excellent qualities." He was a courtier of the emperor *Akber,* who honoured him with especial notice, and a brother of the celebrated *Abúl Fazel.* It is said that his productions amount to one hundred and one in number—among them is the *Siwáti-al-Ilm.* He died of asthma A. H. 1004.

Note.—It is scarcely necessary to remind the reader that most of the specimens of poetry appearing in this notice, are those adduced by the Persian biographers.

Fani.

فاني

This is the surname of *Sheikh Mohsin*, a poet and man of learning, honoured by the esteem of *Dara Shekoh*, brother of *Aurungzebe*. *Fani* travelled some time in Persia and finally settled at Cashmere, where he employed himself in the instruction of youth. He sent to *Mahomed Bakhtawer Khan*, his biographer, two *Masnavis*—one called *Nia*—the other *Haft-Akhter*. A *Diwan* is among his compositions. He was the instructor of *Ghani*. The following couplet is cited by *Mahomed Afael* in the *Tazkiret-i-Serkheish* :

بيت

دیده نهان داشت نقش آن کف پارا

اشک بمردم نمود رنگ حنارا

My eye preserved concealed (within itself)
The resemblance of my mistress (literally, sole of my foot).
My tears appeared to the spectator discoloured (red) with *Hinna.*

Fidái.

فدائی

The surname of *Mirza Rustam Safwi*, an excellent poet, cotemporary with the emperor *Shah Jehan*, and celebrated for his facetious humour. He composed a *Diwan*, from which the following lines are extracted :—

قطعه

برچید دلم بساط ايمانيرا

کج باخته ام نرد خدا دانيرا

ابرو بتی قبلهٔ خود ساخته‌ام

برطاق نهاده ام مسلمانيرا

STANZA.

My heart has torn to pieces the carpet of true religion,
I have played amiss the counter of theology,

I have made the eyebrow of my idol my *kibleh,*
And have placed on the shelf the tenets of Islamism.

Fidai had an elder brother, *Mirza Lahóri,* a man of letters and of an acute genius.

Firdousi Matribeh.

فردوسي مطربه

Flourished during the reign of *Kharizm Shah,* of whom, in allusion to his victory over the Sultans of Gour, he spoke as follows :—

قطعه

شاها زتوغوري بلباسات بجست
مانند چوزه کز کف باشا بجست
ازاسپ پیاده گشت رخ پنهان کرد
فیلان بتو شاه داد وزمات بجست

STANZA.

Oh King from thee the Gourian fled in disguise,
Like a chicken from the talons of a kite,
He dismounted, concealed his visage,
Gave up his elephants to thee, oh King, and escaped destruction.

Fukr uddin Iràki.

فخرالدين عراقي

Bin Ibrahim Abuzerchamher Abdal Ghafúr Zualki, a native of *Hamadan.* His works are remarkable for correctness of style, particularly his *Diwan.* He died at *Jebl-us-Salahim.* A. H. 787.

Furíd Uddin.

فريدالدين

The author of the *Tarikh-i-Guzideh,* merely mentions this poet's name as having flourished at the court of *Sultan Sanjar Seljúki,* of whom he was the flatterer.

Furrókhi.

فرخي

Was a cotemporary of *Firdousi;* and, like that illustrious poet, although sprung from the ancient race of the kings of *Seistan,* was

compelled by poverty to become a tiller of the soil for the yearly sum of one hundred *direms*. On marriage, finding it impossible to live on this miserable pittance, he presented a poem of his own composition to the nephew of *Sultan Mahmúd* I., *Abul Muzaffer*. *Muzaffer* rewarded the poet munificently, and, not content with this, recommended him to the *Sultan* his uncle, who took *Furrókhi* into his service, allowed him a handsome salary, with twenty mounted slaves to attend him.

With *Asjadi* and *Anseri*, *Furrókhi* formed the trio of poets who made the celebrated trial of their great rival *Firdousi's* skill on his first arrival among them, as described under the head "*Anseri*" (Journal No. 8, p. 250).

Fusúni.

فسوني

The surname of *Afazil Khan* who flourished in the time of *Jehangir Badshah;* he was a man of noble birth and of a cultivated mind, and author of a *Sáki Nameh.*

Hakim Senai.

حكيم سنائي

Abu Mejid Mahmúd Bin Adam al Ghuznavi, flourished in the reign of *Bahram Shah.*

Mention is made of him among the *Shaiks*. The *Hadíkeh*—the *Illahi Nàmeh*, and a laudatory poem on *Bahram Shah* are among his productions. *Senái* was the preceptor of the excellent poet *Emàdi*, author of a *Diwan*, who died A. H. 573. It is said that he converted *Emàdi* to a more religious way of thinking by his spiritual instructions. *Senái* was as much respected for the soundness of the doctrines he taught as for the excellence of his poetical compositions.

Hakim Sindi.

حكيم سندي

A native of *Ghazni*—flourished in the 2d century of the Hejira—supposed to have been the first person who wrote a poem in the mystic style, subsequently so much in vogue among Persian poets, *Moulána Rúmi*, *Háfiz* and a host of others.

Haiáti Kiláni.

حياتي كيلاني

A poet in the service of the emperor *Akber*. More distinguished by having erected a handsome mosque at Berhampore, called the *Mesjid-i-Múla Haiáti*, than by his literary productions.

Hemam Uddin.

همام الدین

Of *Tabriz*—cotemporary with *Sadi*—died A. H. 713 during the reign of *Mahomed Bin Arjún*, emperor of the Moguls. The following lines are given as his composition, and are addressed to *Sádi* :—

غزل

بیک کرشمه توانی که کار ما سازي
ولی بچارهٔ بیچارگان نپردازي
بدست باد سر زلف تو یار آمده
که هست پیشهٔ آن هرزه کرد غمازي
مکن تفرج سرو سهي همان بهتر
که عشق باقد و بالای خویشتن بازي
بگل مگو که زرویم خجل نمي گردی
که در میان ریاحین به چمن مي تازي
در آرزوي خیالت غلام خواب شدم
خنک کسی که توئي همنشین و همرازی
اگر حریف مني یک زبان یکدل شو
ولی چه سود که بیچاره نیست شیرازي

ODE.

By one glance thou can'st gratify my wish,
But thou aidest not the helpless :
The tip of thy ringlet has floated into the hand of the zephyr,
That fickle one is habituated to tell tales:
Take not delight in the stature of the stately cypress : it is far better
To be enamoured of thy own lofty figure.
Ask not of the rose, " dost thou not blush at the sight of my face ?"
For thou art [peerless] amid the odoriferous shrubs of the parterre.
For straining after thy image, I have become a victim to sleep.
Happy is he whose companion and friend thou art,
If thou would'st be *my* friend, be single hearted and true.
But what profiteth this? *Shirázi* wanteth not my aid.

Hafiz.

حافظ

Commonly called *Khájeh Hafiz* or *Mohammed Shems-uddin Shirázi*—the greatest lyric poet of Persia. *Hafiz* was born at *Shiraz*, in the reign of *Sultan Shah Mansur*, fifth monarch of the *Mozafferians*, who flourished in the eighth century of the *Hejira*. He died at the same city according to Herbelot A. H. 797, just at the time that Sultan *Baber* took the place. Reviezy states that his death happened when *Omar Shaik*, son of *Tamerlane*, took *Shiraz* a few years earlier, and *Doulet Shah* fixes the date of his demise 794 A. H. M. de Sacy, for reasons that will be mentioned, thinks that this event could not have taken place before 795, and this opinion seems most plausible.

Of the life of *Hafiz* little is known. He appears to have seldom wandered beyond the boundaries of his native province *Fars*, and to have remained leading a meditative luxurious sort of life at its celebrated capital *Shiraz*, and entertaining a philosophic contempt for the world and its cares. His renown, however, travelled far and wide, and he found himself assailed by tempting offers from various princes to quit his native land and reside at their courts.

Ferishta relates that one of the kings of *Kulbúrga*, *Mahomed Shah Báhmeni* I. who commenced his reign A. H. 780, and was a great patron of Persian and Arabian poets, sent him a present, together with a letter from his minister *Mir Faiz Allah Anjú*, inviting him over to *Kulbúrga*. *Hafiz*, over-persuaded, quitted *Fars* and embarked for *Hindustan* at *Ormus ;* but, encountering a severe storm, the vessel in which he sailed was forced to put back. Our poet, deterred by this inauspicious event, and not encouraged by the little *desagrémens*, incidental to landsmen on shipboard, he had experienced during the stormy trip, determined not to tempt the fates farther, and accordingly returned to *Shiraz*, but not without having first despatched an ode by the same vessel to the king of *Kulburga's* minister, in which he deplores the crime he had been guilty of in having suffered himself to be seduced by gems and gold to forsake his country, friends, and, last though perhaps not least, the delicious wine of *Shiraz*, for the splendour of a foreign court. The king was extremely delighted by the elegance of style manifested in this ode, and delivered over a thousand pieces of gold to *Mahomed Cassim Mushidi* to purchase presents for the poet of *Shiraz*—but whether these presents ever reached *Hafiz* is to this day much doubted by the learned.

Hafiz also sent a complimentary copy of verses to *Sultan Ahmed*, son of *Sultan Aweiss Jelahir*, monarch of *Bagdad*, who had in vain tempted him to forsake *Shiraz* for that city. The following anecdote illustrative

of *Hafiz's* lively wit extracted from *Doulet Shah*, is found in a short account of his life contained in the Asiatic Journal for November 1829.

" The emir, *Timoor Koorkan*, having made himself master of the province of *Fars*, in the year 795 (A. D. 1392-3), caused *Shah Mansoor* to be put to death.* *Hafiz* was then alive. *Timoor* desired him to be sent for; and when he arrived in the presence, *Timoor* said to him: " I have subjected with this sword the greatest part of the earth; I have depopulated a vast number of cities and provinces in order to increase the glory and wealth of *Samarcand* and *Bokhara*, the ordinary places of my residence and the seat of my empire; yet thou, an insignificant individual, hast pretended to give away both *Samarcand* and *Bokhara*, as the price of a little black spot, setting off the features of a pretty face; for thou hast said in one of thy verses:

" If that fair maiden of *Shiraz* would accept my love,
I would give, for the dark mole which adorns her cheek,
Samarcand and *Bokhara*. †

" *Hafiz* bowed to the ground before *Timoor*, and said to him: " Alas! O prince, it is this prodigality which is the cause of the misery in which you see me." This repartee delighted *Timoor* so much, that instead of finding fault with him, he treated him with kindness."

* " There can be no doubt," observes M. de Sacy, in a note upon this passage, " that the second expedition of Tamerlane, into the province of Fars, is here referred to, since it was in that war that Shah Mansoor perished: wherefore I prefer the reading of one of the MSS. 795; the other copies bear different dates.

" Sherefeddin Ali places this expedition and the death of Shah Mansoor in the year 795. But if Hafiz died, as Doulet Shah tells us, in 794, what he relates above must have taken place at the first conquest of Shiraz. The prince who possessed that city having fled, it surrendered to Timoor, who entered it, according to Sherefeddin, A. H. 789. One of the MSS. of Doulet Shah has the date 790, which is near enough. Probably the author confounded together the two expeditions of Timoor."

† " Sir Wm. Jones has exquisitely *paraphrased* the entire ode from whence this verse is taken. The lines above quoted are thus rendered by him, without allusion to the *mole*:

Sweet maid, if thou would'st charm my sight,
And bid these arms thy neck infold;
That rosy cheek, that lily hand,
Would give thy poet more delight
Than all Bokhara's vaunted gold,
Than all the gems of Samarcand."

The verse in the original is as follows:

اگرآن ترک شیرازي بدست آرد دل مارا
بخال هندويش بخشم سمرقند وبخارا را

The answer of *Hafiz*, however, according to other authorities, was, "Can the gifts of *Hafiz* ever impoverish *Timoor ?*"

It appears from the works of *Hafiz* that he was led to expect preferment and reward from the king of *Yezd*, in which hope he was doomed to bitter disappointment. He is sometimes styled *Lissan-al-ghaib*, the hidden tongue, from the mystic allusions with which his works are supposed to abound. The appellation of *Hafiz* he obtained from his perfect knowledge of the *Koran*—the Arabic word *Hafiz*, among other meanings, signifying one who has the whole *Koran* by heart.

Other Persian poets have had the same title—among the rest one surnamed *Ajim Rími* and another *Halvâi*, that is, the seller of sweetmeats, who lived in the reign of *Sultan Shah-rukh*, son of *Tamerlane.*

The poems of *Hafiz* were collected after his death into a *Diwan* by his disciples, and chiefly by *Syed Cassim Anwar* who employed himself constantly in committing them to memory.

According to Herbelot they have been commented on by *Ahmed Feridun*, who has explained the mystic allusions in the Turkish language. The terms wine and love, which perpetually recur, he says, signify the transports of a soul under the direction of a spiritual guide, who leads it by elevated paths up to the summit of perfection. The odes in the *Diwan* are arranged according to their *Kadifs* (the rhyming words of a poem), which follow the order of the letters composing the Arabic alphabet.

Hafiz lies interred at *Shiraz* in the *Musalla* or oratory. According to *Doulet Shah*, when Sultan *Baber* took the city, *Mahomed Mimai* erected a handsome chapel and monument over his remains. The tomb remains to this day one of the principal lions of *Shiraz*—it is of white marble bearing two of the odes of *Hafiz* beautifully cut, and is enclosed in a quadrangle, called the *Hafiziah* planted with cypress trees, those beautiful though mournful ornaments to most of the Mahomedan burial grounds in India and Persia.

Sir Wm. Ousely mentions that the *Diwan* of *Hafiz* is preserved as a *Wakf* وقف religious property, in a chamber near the poet's grave. He does not consider this volume to be the same as that described by Pietro Della Valle, who visited the tomb in 1662. *Shah Abas*, then king of Persia, had removed to his own library, the original autograph, which had been deposited where the body lies. Sir William, however, doubts whether such a book ever existed, since the poems of *Hafiz* were not collected till after his death. This book is still celebrated on account of the number of great men who have travelled to *Shiraz* for the express purpose of consulting it for a *sors.* Among the rest, that scourge of the east, *Nadir Shah.* The tomb at present, I believe, is the resort of a number of idle dervises.

Sir Wm. Jones, in his essay on the mystical poetry of the Persians and Hindus, observes : "It has been made a question, whether the

poems of *Hafiz* must be taken in a literal or in a figurative sense ; but the question does not admit of a general and direct answer ; for even the most enthusiastic of his commentators allow, that some of them are to be taken literally, and his editors ought to have distinguished them, as our Spenser has distinguished his four odes on Love and Beauty, instead of mixing the profane with the divine by a childish arrangement, according to the alphabetical order of the rhymes. *Hafiz* never pretended to more than human virtues, and it is known that he had human propensities ; for, in his youth, he was passionately in love with a girl surnamed " *Shakh-i-Nebat*, or the branch of sugar-cane," and the prince of *Shiraz* was his rival.

" Since there is an agreeable wildness in the story, and since the poet himself alludes to it in one of his odes, I give it you at length from the commentary." There is a place called *Pir-i-sabz*, or the green old man, about four Persian leagues from the city ; and a popular opinion had long prevailed, that a youth, who should pass forty successive nights in *Pir-i-sabz* without sleep, would infallibly become an excellent poet.

" Young *Hafiz* had accordingly made a vow that he would serve that apprenticeship with the utmost exactness, and for thirty nine days he rigorously discharged his duty, walking every morning before the house of his coy mistress, taking some refreshment and rest at noon, and passing the night awake at his poetical station. But on the fortieth morning, he was transported with joy on seeing the girl beckon to him through the lattices and invite him to enter. She received him with rapture, declared her preference of a bright genius to the son of a king, and would have detained him all night, if he had not recollected his vow, and, resolving to keep it inviolate, returned to his post.

" The people of *Shiraz* add (and the fiction is founded on a couplet of *Hafiz*) that early next morning *an old man in a green mantle*, who was no less a person than *Khizr* himself approached him at *Pir-i-sabz* with a cup brimful of nectar, which the Greeks would have called the water of Aganippe, and rewarded his perseverance with an inspiring draught of it. After his juvenile passions had subsided, we may suppose that his mind took that religious bent, which appears in most of his compositions."

The learned natives of India with whom I have conversed on this subject, will by no means admit that the wine, love, and intoxication of *Hafiz* have reference *in any* of his compositions to mere terrestrial enjoyments, alleging that if he had thus broken the law of the Prophet, he could never have entered the gates of paradise, which the following story, they say, proves he did. On *Hafiz's* death, the *Moollas* refused his corpse the rites of sepulture, stating that he had forfeited all right thereunto by the loose and highly immoral tendency of his works and course of life. This affair excited considerable dissension and alterca-

tion among the people of *Shiraz* who expressed a different opinion; insomuch that it was finally agreed on to open at hazard the works of the deceased poet for some passage, by which the point under discussion might be decided. This plan was eagerly adopted and put into execution, when, to the great joy of the relatives and friends of *Hafiz*, the first words that met their eyes were these :—

> Avoid not the tomb of Hafiz, for, though not free from guilt, he will notwithstanding be admitted into Paradise.

This quite convinced the most sceptical ; the poet's remains were interred with due solemnity, and his tomb became in after times a place of pilgrimage, deemed as holy as that of the shrine of our Lady of Loretto, where kings and emirs have consulted with implicit faith the fortuitous oracles of the divining volume previously alluded to.

There can be, I think, no doubt that a large proportion of the odes which appear to the general reader as referring to sensual pleasures, merely have an abstruse connexion with the mystic doctrines of the *Súfis*, sometimes so remote as scarcely to be traced by the initiated themselves. Hence the half-read *literati* of India finding themselves at a loss to touch the clue, and to separate the physical from the metaphysical, cut at once the Gordian knot by boldly averring *the whole* of *Hafiz's* poetry to have a spiritual meaning. It seems clear on the other hand that he could not have given such vivid descriptions of the gradual intoxicating effects of wine, and the voluptuous sensations of love, had he not some time or other experienced them. The way he lived too, bears out the opinion that he was half-sensualist—half-devotee—a sort of union frequently occurring among the dreamy fanatics of the east. Most native authorities agree that he passed his time partly among the gay and dissipated, and partly among *Faquirs* and ascetics. The former sang his odes as Anacreontics and *Chansons à boire*, the latter studied them as sacred mysteries.

As *Firdousi* is generally allowed to be the Homer of the Persians, with equal correctness may *Hafiz* be called their Anacreon. His style is original, full of vigour and sweetness of thought, his ideas fresh and racy. He never rises to the sublime, but is generally concise, and always elegant. He is copiously quoted by Persian authors, particularly by the author of that *pot-pourri* the *Nigaristan*. Distiches from his *Ghazls* are in every well educated Persian's mouth, and many are applied as proverbs in the ordinary occurrences of life. His productions resemble those of the lyric poets of Greece, being a collection of odes and elegies—chiefly on love and wine.

The lyric style in Persia, as in Greece and elsewhere, succeeded the epic. The Grecian minstrels were wont to sing to the notes of the *κιθάρα* or *λυρα*, the odes of Archilochus, Sappho and Anacreon, while

the Persian *Mutribs* chant the *Ghazls* of *Hafiz* and *Jámi* to the sound of the *Burbut* and *Rubáb.* There can be no better testimony to the merits of *Hafiz* than the numerous and talented translators his odes have attracted, and it may not be doing an injustice to the memory of our favourite poet, to cite here the evidence of a few of his admirers, in the shape of some of the odes which they have selected for translation.

The first is from the pen of the elegant Sir Wm. Jones. It has not been here presented to the notice of the reader, because Sir William is more felicitous in his translation into French than into English ; but in the idea that it may have escaped the very general notice his English versions from the same author have attracted. The ode is addressed to the Zephyr.

ODE X.

I.

" O Toi, léger et doux Zéphire,
Quand tu passes par le séjour
Où l'objet de mon tendre amour
Entouré des grâces respire,
Fais qu'au retour, selon mes veux,
Ton haleine soit parfumée
De cette senteur embaumée
Qu' épand l'ambre de ses cheveux.

II.

" Que de son souffle favorable
Mon être seroit ranimé,
Si par toi de mon bien-aimé
J' avois un message agréable !
Si trop foible tu ne peux pas
Porter ce poids, à ma priére
Jette sur moi de la poussiére,
Que tu recueilles sous ses pas.

III.

" Mon ame languit dans l'attente
De son retour si désiré ;
Ah ! quand ce visage adoré
Viendra-t-il la rendre contente ?
Le pin fut moins haut que mon cœur,
A présent, au saule semblable,
Pour cet objet incomparable
Il tremble d'amoureuse ardeur.

IV.

" Quoique celui que mon cœur aime,
Pour ma tendresse ait peu d'egards,
Hélas ! pour un de ses regards
Je donnerois l'univers même.
Que ce seroit un bien pour moi
Puisqu' à ses pieds le sort m'enchaine,
De n'avoir dautre soin ni peine,
De ne vivre que pour mon roi."

The second is a paraphrase of one of Hafiz's metaphysical effusions, by that veteran in Oriental literature, Dr. Gilchrist. It may be regarded as a tolerable specimen of the mystic poetry which Hafiz was accustomed occasionally to bewilder his disciples with.

I.

"Hail, heavenly spark! that glorious day,
When thou, released from circling clay,
May soar to realms of bliss:
No longer shall this frame confine,
A soul inspired with love divine,—
Pure bird of paradise!

II.

"God's mystic scheme I vainly scan,
And grasp his mind infused in man;
These—far transcend my song.
Through death's deep gloom, how wing my flight?
To that eternal source of light,—
Eclipsed from me so long.

III.

"Eccentric spirit! why first roam
To earth—from heaven thy native home?
Where kindred angels dwell.
How like the bounding musky deer,
Thou still art doomed to anguish here,—
This yearning heart can tell.

IV.

"Those radiant orbs,—Earth's vernal bloom,
Lose all their charms while I consume,
With melting sighs on sighs;
Yes, bright Intelligence! I see,
My *self* cannot descend to thee,
Till mortal *Hafiz* dies.

The following is a sudden transition from the sublime to the terrestrial. *Hafiz* must have written the first part of it on awaking after a midnight debauch, and concluded it whilst on the point of quaffing his second goblet of hock and soda. The translation is a literal one by Wm. Ouseley, Esq.

"This monkish habit which I wear shall serve as a pledge for wine, and this unmeaning volume (his Koran) shall be sunk in an ocean of good liquor.

"How have I wasted life!—as far as I can look around, we owe our ruin to the love of wine and dissipation.

"How remote is true meditation from the profession of a Derveish, or a state of poverty! My breast is all on fire—My eyes full of tears.

"I shall not tell the story of my enamoured heart to the world: or if I do tell it, it must be to the sound of the harp or violin.

" As the sphere of the world thus moves round without intermission, my head is giddy with a possession for the lovely cup-bearer, whilst my hand seizes the goblet of wine.

" From a mistress like thee, I can never turn away my heart—Yes—but if I do, at any time, it will be only from one of thy ringlets to another.

" When you shall be old, Hafiz, then depart from the wine tavern : but first enjoy, whilst young, the pleasures of drinking and of convivial mirth."

The following is by an anonymous hand :—

I.

" The anguish of love I have borne,
Do not ask me its pains to unfold ;
In absence I've wandered forlorn,
But that torture can never be told.

II.

" Through the world without love I had stray'd
Till at length a sweet ravisher came ;
My heart's warm emotions she sway'd,—
But I cannot reveal her dear name.

III.

" In the soft hour of silence last night,
Such words from her lips fell so sweet,
As fill'd my fond heart with delight—
But those words ask me not to repeat.

IV.

" A lip of the ruby's bright hue
I have press'd, and the joy thrill'd my heart;
Though I speak of the transports to you,
Whose the lip——I will never impart.

V.

" Alone, in my cottage retired,
Ah ! still there's no end of my woes ;
Such the love which my bosom has fired ;
Such the grief as I cannot disclose."

Hafiz was extremely attached to his native city *Shiraz*, and in a beautiful ode, partly translated into Latin by Sir Wm. Jones's learned friend the Baron Reviczky, celebrates its beauties, and entreats for it the divine protection.

" Felix amæno conspicuum situ
Schirazum ! Evoe grandi decus plagæ ;
Dî te bearunt, dî te ab omni
Exitio tueantur ævi." &c.

Specimen Poeseos Persicæ. Proem. XXII.

(To be continued.)

XVI.—*A notice of the Malayan Code.—By Lieutenant* T. J. Newbold, A. D. C.

According to Malayan tradition the world was, from a very early period, divided into three great empires, among which Mahomedan writers give precedence to that of *Rúm;* the empire of *Chín* or China, holds the second place, and that of *Pulo mas* the golden island, or empire of *Menangkábowe*, the third. This last is situated in the island of *Semut-raya* or Sumatra. From it the Malays trace their origin, their laws civil and criminal, their forms of government, state etiquette, &c.; also rules for the division of lands by boundary marks and the classification of the people into tribes or *Súkús*. This empire is absurdly alleged by Mahomedans to have been founded by a descendant of Alexander the Great. It flourished during a considerable time in great splendour: the religious veneration in which it is held to the present day by Malays, and its ancient local remains, certainly indicate a high comparative state of former civilization.

Emigration, the natural result of increased population and prosperity, took place during the eleventh and twelfth centuries of the christian era, and probably at a much earlier period, not only to various places on the east and west coasts of Sumatra, but also to the island of *Singapúra* and the extremity of the Malay peninsula, "*Ujong Tannah.*" Thence expelled by the invaders from *Majapahit* (A. H. 650) the settlers proceeded, after various vicissitudes, to Malacca, where they finally settled and founded a city [A. H. 673], afterwards famed as the wealthy metropolis of the spicy east, and now sunk into insignificance.

Prior to the founding of Malacca, these adventurous colonists, who, like the Greeks, early distinguished themselves as a maritime people, had gradually overspread the coast on both sides of the peninsula, until they found themselves checked in their progress to the northward by the ancient and powerful kingdom of Siam, which, both politically and geographically, crests the Malayan states. Foiled here, and stimulated by mercantile and piratical speculations, they turned the prows of their vessels eastward, and effected settlements on the most fertile of the beautiful and verdant islands which begem the bosom of the Malay archipelago. The spicy Moluccas and isles of the *Súlú* archipelago, did not escape their notice; repassing the equator they may be traced through the sea of *Banda*—southwards and eastwards along the western coast of New Guinea, by the isles of *Arroo* and *Timor* to the confines of Austral Asia.

In course of time these widely separated colonies, adopting partly the manners of, and intermarrying with, the various nations they were thrown among, found themselves under the necessity of adopting

many of the original laws they brought with them from the parent state *Menangkábowe*, to the exigencies of their new situations. The progress of civilization and introduction of Mahommedanism brought on other and more important changes.

Hence the discrepancies observable in the numerous codes of laws, existing throughout the wide and straggling extent occupied by these colonies.

Almost every Malay state has its peculiar code—*Adat* or *Undang Undang*—some are written, but many are mere oral traditions; the written compilations are blended and interpolated with the law of the *Shéra* and *Aiats* from the *Koran*. Still a family resemblance is, I think, to be traced throughout all.

The principal codes are those of Menangkábowe, Malacca, Johore, Quedah, Achin, Palembang, Moco Moco, and Siac.

Having thus rapidly noticed the state of society producing these deviations from the parent code of Menangkabowe, I shall, without farther comment, proceed to give a cursory analysis of the principal one—namely, that of Malacca. The greater part of this celebrated code was compiled during the reign of *Sultan Iskander Shah*, who founded the city of Malacca A. H. 673. His laws were afterwards collected and re-arranged, with many additions and alterations, by *Sultan Mahmúd Shah*, who commenced his reign A. H. 675. At this time probably, the great admixture of Mahommedan law took place. This compilation appears to extend, in an integral state, only so far as *Fasl* XXXIII. The rest was collected by *Sultan Suliman Abdal Jalil Rahmet Shah*, through the agency of his minister *Bandahára Tan Hussan*. This last part contains a few ancient regulations, that possibly had escaped the notice of the former compilers—some that had been already laid down, with slight modifications; and a few enacted by *Rahmet Shah* himself.

The entire code is divided into two distinct parts—the land and the maritime—the latter has been translated and commented on by Sir Stamford Raffles; the former comprises eighty-one *Fasls* or chapters, treating principally on criminal law, laying down penalties and fines, together with regulations for the etiquette to be observed at the courts of Malay princes, and rules for the guidance of the chiefs and principal officers of state.

Many of the regulations have been blended, as previously remarked, with the law of the *Koran ;* but, as a whole, the code retains, generally, strongly defined features of its Malayan origin. Some of them, it will be observed, bear resemblance to those laid down in the *Mánara Dherma Sástra*, or Institutes of *Ménu* ; although there is nothing, in the present Malay code, analogous to the regulations for the distinctions

of *caste* and religious observances, which constitute the prominent characteristics of the Brahminical laws. At all events if this had ever been the case, the influence of the Mahommedan religion, which prevailed at so early a period at Malacca, would most effectually have obliterated all traces of the worshippers of *Brahm* from pages destined to be emblazoned with the *Aiats* of their own sacred volume. Local necessity could have alone induced the followers of Islam to tolerate so many of the regulations established by Malayan usage, the *Adat Malâyu d'húlu kála.* The law of inheritance is the same as enjoined by the *Koran ;* the punishment for criminal offences generally more severe.

By Malays themselves their laws are supposed to be based on three points,—the *Hukum Shera,* which is the law of *Mahomed*—the *Hukum Akl,* cases not provided for, where the judge must be guided purely by the general principle of justice and his own discretion—and, lastly, the *Hukum Adat,* which is the law of old established custom and national usage. The *Hukum Shéra,* in all cases where it applies, must be adhered to in preference to the others.

In the code of the Javans (*Súria Alem,* Art. III.) it is remarked—" The *Tri-rása-upáya,* as known among men, comprehend three things which are intimately connected with each other, but which nevertheless must not be confounded, namely, first, *Húkum;* second, *P'rentah;* third, *Kasúsahan.* Where a sentence is very severe, or of a nature which will not admit of its being fulfilled, a mitigation or commutation thereof can only take place by a careful consultation of what is written in the book of laws." The term *P'rentah,* which signifies the edict of the sovereign, and *Kasúsahan,* signifying oppression, are here substituted for the word *Adat* which occurs in the Malacca code, and, as before stated, means established usage. The substitution may be explained by the oligarchic form of government which long prevailed in Java. There are many copies of the code of Malacca to be found among the natives of the peninsula, and, as in most other Oriental MSS. differences will be found in all. The MS. I am at present engaged in translating was selected for me, in 1834, from a number of others, by the late Sultan of Johore, who was a lineal descendant from the ancient sovereigns of Malacca.

XVI.—Notices of Books.

1.—*An Epitome of the History of Ceylon, compiled from Native Annals: and the first Twenty Chapters of the Mahawanso. Translated by the Honorable* George Turnour, Esq. *Ceylon Civil Service. Ceylon, Cotta Church Mission Press,* 1836.

The present day is one of more accurate historical research into the antiquities and mythology of Asia, than any one which preceded. It is better understood that garbled reports of what natives have said, noted down by persons unacquainted with the native languages, and unaccustomed to accurate investigation, do not form a medium of information that can be depended upon, or one which will stand the test of further and more scrutinizing enquiry; however much some of those narratives may have amused or surprised their readers, they have, in many cases, been nothing more than some facts mingled with much fiction, and disguised with error. The disdain once felt for mere translation is receding before surer principles; and it is felt, that if we would come at an accurate knowledge of native literature and customs, we must patiently and perseveringly translate these writings, mingling therewith none of our own conjectures; printing both original and translation, and then drawing conclusions, or framing remarks; or else leaving the inferential part of the process to the future and more general historian.

No small pleasure is felt in welcoming to the field of historical research, another and a competent labourer; one who evidently understands the value of the principle just adverted to, and has acted upon it, with a zeal, perseverance and talent, in the highest degree creditable. The Honorable Mr. Turnour in acquiring Singhalese to qualify himself for the discharge of official duties, was led on to the *Pali,* finding it always referred to as an authority; and among *Pali* works the *Mahawanso,* or great genealogy, was found to be so generally acknowledged as a superior authority, that he was induced to undertake its translation. This task after proceeding to some extent he was led to discontinue, in consequence of hearing that the *Mahawanso* was likely to come out in England, under high auspices, and with no small apparent claims to the fullest estimation and confidence. A perusal of the specimen received in Ceylon, convinced him that these claims were strikingly deficient, and induced him to resume his undertaking. The title at the head of this notice is that of a specimen only; the first volume in quarto is soon to make its appearance, and the issue of the second will be conditional. It is not necessary to enter upon the comparative merits of the two rival works. Apart from a strong personal conviction that historical publications, upon the translation and annotation

principle, can never be satisfactorily edited in England, there appears enough in the analysis before us, to lead to a conclusion, that, though the London printed work is worthy of being commended in its motives, and would doubtless be valuable in the non-existence of any more accurate version, yet that the work undertaken by Mr. Turnour, and printed in Ceylon, with all competent native and other assistance around him, is likely to be very superior, and as an authority perfectly decisive. Judging, indeed, from the specimen of style given in an extract from the other work, it appears a pity that what could be done in England was not done, that is the correction of a translation by a native of Ceylon into English, so as to render the translation in some degree idiomatic. However to pass by that circumstance, trivial perhaps in itself, though by no means so when a large work of some pretensions is concerned, it is of more consequence to observe, that, while the copy of the *Mahawanso* carried to England with a rude accompanying translation was not complete, being in some places merely an abstract, the copy used by Mr. Turnour was full, and collated with another copy obtained from the opposite eastern peninsula, while the printing the text and translation together will be a safeguard against any slight but unintentional errors, the possibility of which Mr. Turnour acknowledges. Indeed, in every case where his own qualifications are in question, there is a tone and manner which elicit confidence: there is no inflation pompousness, or self-conceit, but the marks of a patient, investigating and well-disciplined mind. Perhaps he is a little too keen in his critique on the rival work, *apparently* of much pretension, without much merit; but the writer of this brief notice has not seen that work, and by consequence cannot judge from the result of personal inspection.

As to the *Mahawanso* itself, Mr. Turnour wishes to have other opinions than his own on its intrinsic merits or general value: and it is a wish in which the readers of this journal will naturally participate. The writer of this notice does not venture to give an opinion unrequested; and it remains simply the opinion of one person, who has not the slightest desire to do more than contribute a very humble quota towards aiding the judgment of others, who may not have paid so much attention to similar pursuits; while it is subject to be entirely controlled by the judgment of those who are better versed in matters of oriental enquiry. The writer must then say that he considers the *Mahawanso* to be a valuable addition to otherwise existing stores of knowledge. In the specimen now under notice there is a preponderance of fable over fact; but there are facts of considerable consequence. The chief one seems to be the light thrown on a heretofore obscure portion of the later history of *Mágadha;* but there are other hints and indications, of occasional occurrence, of some consequence towards tracing out a general history of ancient India. Thus the origin of *Ougein* (or more

correctly *Ujjaini*) was, to the best of the writer's knowledge, quite impenetrable. In *Brahmanical* annals and fables, we find that a king was reigning there, whose daughter was married to a *Brahman*, whence proceeded the famous *Vicramaditya*, who shines a splendid meteor of some duration, but emerging from darkness, and leaving behind a darkness almost as great as before. Of the period succeeding him some account has been, and something more yet can be, given; but as to the antecedent period, what *Ujjaini* was, or how it arose, we knew not.

The *Mahawanso* enables us to perceive that it was originally a principality appertaining to the great *Mágadha* kingdom; and one of so much consequence as to be confided to the heir apparent of *Mágadha:* in order also to remove him from the temptation of dethroning and murdering his father. Besides, the clear and definitive tracing of *Bauddhism* to *Mágadha*, is something; considering the great influence of that form of religion on vast portions of the great family of mankind. The writer of this notice, from indications afforded by some papers in the Asiatic Researches, heretofore traced the origin of that system through *Calinga*, as he supposed, and up to *Mágadha*, as its primary seat; with some remaining doubt whether Benares might not have participated; but doubt is now removed, and *Mágadha* plainly appears to claim this distinction, such as it is. Further, in the account of the different journeys, undertaken to spread the *Bauddha* system among surrounding nations, we find satisfactory statements as to its rise in Cashmir, Nepal, Birmah, Ceylon, and lastly, *Banavasi*, on the western coast of India. The writer of this notice heretofore took the liberty, with some diffidence and hesitation, to question the truth of the hypothesis very confidently maintained by some authors, that the *Jaina* religion and that of *Buddha* were different. Having been led, by such information as he then possessed, to believe that *Bauddhism* came to Ceylon by way of *Calinga* and Siam, it was his opinion that the differences existing (attended with a commanding similarity) between the *Jaina* and *Bauddha* divisions, arose chiefly from the mode of transit: the former travelling down the continent of India, and possibly meeting with modifications in its progress. The opinion, formed on imperfect and only approximating data, is much strengthened by information in the *Mahawanso* that a deputation went from *Mágadha* to what is conceived to be the northern Concan and Khattiwar, while another division of teachers went to *Banavasi*, a capital of repute on the western coast of India; whence it may be presumed it spread to *Talcàd*, the ancient capital of the *Conga* country, or modern Coimbatore, and to probably another *Talcàd* above the ghauts, the capital of the *Haysála* kingdom, in the now so called country of Mysore. At this latter place the *Jaina* faith was once seated on the throne. Thus we may trace the *Jaina*

system to *Mágadha*, while there exist materials to shew, that *Bauddhas* came over from Ceylon into the *Pandiya* and *Sora*, or *Chola*, countries; or the districts surrounding Tanjore, Trichinopoly and Madura. This question requires to be further pursued in order to be fully cleared up, and the doing so is of some subordinate consequence. The illustrations of *Bauddhism* itself, contained in the *Mahawanso*, are valuable; so also will the local history of Ceylon itself doubtless prove. The *Yakkas* (or as we have it in India *yacshas*) Mr. Turnour may be fully assured were not demons; but, as he appears to intimate, human beings. With the *Brahmans*, and their followers, all races and tribes of people, not of recognized Hindu descent, are *asuras*, *nágas*, *yacshas*, or *racshasas*, the supernatural attributes and character with which these are invested, in Hindu books, are all quite in keeping with the narrative. In a Tamil work professing to give an account of the family and lineage of *Rávana*, the people of his race are expressly said to have been *Yácshas* and *Rácshasas;* and the difference in appellation between two kindred families is fancifully traced up to a particular conformation of the organs of speech: so that while one tribe or family pronounced a word propounded to them *ráchsa*, another sounded it *yáchsa*. It seems that the identity of *Lanca* with Ceylon can be traced on the spot: this circumstance that Tamil writings speak of *yacshas* as of *Ravana's* lineage, while *Pali* writings mention the *yakkas* as inhabiting Ceylon, is a further confirmation. But the fact is quite undoubted in this peninsula: evidence in abundance the writer has heretofore placed before the public; more could be added were the doing so needful.

The statement, therefore, quoted by Mr. Turnour, on the authority of Colonel Tod, that the *Pandits* of the north-west of India "scouted" the idea of Ceylon being *Lanca* is simply, like many other odd or unaccountable things, which have been stated on the authority of *Pandits*; or must, in this case, be ascribed to the local distance, and mental ignorance, of these individual *Pandits*, without disparagement to their body. It may be a digression from the main subject; but, in passing, the reference to Colonel Tod's notice of *Jaina* MSS. at Jessulmer, leads on to a bold statement by Lieut. Webb, appended as a note to the Proceedings of the Bengal Asiatic Society in April 1835, to the effect that we are all in the dark, and must be content to declare our ignorance of Hindu literature, until the libraries of Patan in Rajputana, Jessulmer and Cambay, with private libraries of *Jaina* teachers, have been explored. There is doubtless a measure of truth in this statement. From the era of *Asaca verdhana* of *Mâgadha*, down to the foundation of *Vijeyanagaram*, or in round numbers from about B. C. 300, to A. D. 1200, a long sweep of 1500 years, an accurate knowledge of all *Jaina* records would be inestimable. Whether records of antecedent times, from

Jaina or *Bauddha* authorities, would be so very valuable as to eclipse all former knowledge, it may be permitted, possibly, to doubt, without deciding.

This may be the place to express the incredulity that is felt, as to any statements of matters antecedent to *Buddha-Gautama.* He is clearly an historical personage; his predecessors are evidently fabulous; the artificial plan of the statement, by its own internal evidence, proclaims fable and invention. Such, also, are, it is conceived, the three alleged visits of *Buddha* in person to Ceylon: where all connected circumstances are self-evidently fabulous, the event narrated is fabulous. The like remark holds good when *Mahindo,* the religious envoy from *Màgadha,* is represented as narrating to *Dewanaupiyatiso,* the first convert king of Ceylon of the race of *Vijeya,* that other *Buddhas* antecedent to *Gautama* had visited Ceylon, and consecrated special localities by their presence. The obvious object in view, and the precise uniformity of expression and poetical metaphor, as to the three antecedent visits, evince that *Mahanamo* the author of the early portion of the *Mahawanso* had the fictitious glory of his religion, and the flow of his versification more at heart, than historical precision, or concern as to what critics might hint on the laws of evidence, and of internal evidence in particular. No one, however, will suppose that the statements of the *Mahawanso* are to be implicitly received; and the object of these immediately preceding remarks is to hint a conviction that with *Buddha-Gautama* all *Buddha* and *Jaina* history begins; and that all the value of that history is posterior to "the advent of the vanquisher."

For giving the *Páli* text in Roman orthography, on a defined system, the literary world will be obliged to Mr. Turnour. The *Páli* letters to which the Roman symbols are attached, have a prevailing resemblance to the Telugu characters; three of the signs are nearly the same as the Tamil representatives of the same tenour. In all the *Páli* alphabets the signs for *pa* and *ya,* are uniformly very nearly the same with the Tamil characters. An opinion is entertained that the *Páli* of the *Mahawanso,* may be found to be very similar to the *Kawi* of Java. However, to be brief on this theme, the *Páli* and *Sanscrit* are closely related. It seems, from Mr. Turnour's account, that the *Bauddhist* teachers of Ceylon lay claim to superior antiquity of the *Páli* or *Màgadha* dialect, to the Sanscrit; supported by a passage (quoted hereafter) from the oldest *Páli* grammar, that of *Kachchayano,* purporting that the *Mágadhi* is the original language spoken by men and *brahmans,* and by all the *Buddhas* from the beginning of the present creation. Now this proof is rather reasoning in a circle, and proves nothing more than this, that the author of the grammar thought to

magnify his favourite language by the assertion, which amounts only to the testimony of *Kachchayano*—and who was *Kachchayano*, and what grounds have we to receive his testimony as implicitly as do the Bauddhist teachers? But, apart from such questions, nothing more is requisite than this very verse to shew that the *Mágadhi* language could only be a modification of the Sanscrit language, leaving the claim to superior antiquity for the present in abeyance. There are in it, however, words common to Telugu and Tamil, but not Sanscrit; lending some force to an opinion that a common dialect, not Sanscrit, once ran through the whole of the continent of India. The writer has more than once thought that the earliest *Brahman* settlers (strangers originally to India) brought with them the ancient *Pahlavi*, and engrafted it in written works on the common dialect of the land, as Norman-French once, and Latin subsequently, were engrafted on Saxon-English, so to make the language of our books; which differs as widely from the dialects of many English counties, as the *Hindí* or *Mágadhi* possibly could from the Sanscrit. Great authorities, and Mr. Colebrooke among them, have thought otherwise; let time and enquiry decide. It is perceived that the *Páli* always rejects *l* and *r*, in Sanscrit words; thus *Kalpa* and *Chakraverti*, became *Kappa* and *Chakkawatti*; another peculiarity is the changing short *a* into *o*; and the general tendency of the *Páli* is to soften, or perhaps emasculate, the Sanscrit in words evidently the same.

It could have been wished that Mr. Turnour had avoided the great blemish which attends almost all Asiatic researches hitherto; which is the use of theological, or scriptural terms, derived from the Christian religion, and applying them to other religions; as though all were very much the same; and, by an infallible consequence, derivable from an assent to that leading proposition, that all religions are puerile, fictitious, or contemptible, with some not very important shades of difference. It has been, and it shall always be, the object of the writer to protest against any such confounding of things that essentially differ. Many writers cannot be absolved from malicious intentions in such wilful and often studied parody; but Mr. Turnour clearly is acquitted of any such design. Either he followed false models, supposing them to be true ones; or else it was his opinion, to the best of his judgment, that this was the most suitable kind of translation. This remark, which cannot be omitted, is the only one of the kind necessary; and it diminishes not the importance of the work, at least in its main features.

The question whether the history of India will ever be satisfactorily developed, on which Mr. Turnour dwells, without being either sanguine or despondent, is one which may be considered as of hopeful answer.

He does not enumerate every thing that has been published on the subject; and has no idea of the resources of the Asiatic Department of the Madras Literary Society if they were developed His own work is an important accession to the history of India in connexion with Ceylon, and it is a work which promises to be so well accomplished in his hands, that no one it is hoped will be disposed to stint him of his full and merited measure of praise and encouragement.

The following specimens may serve to convey to the reader some idea of the spirit and manner of the Epitome. The first is from the Introduction :

" My object in undertaking this publication (as I have already stated) is, principally, to invite the attention of oriental scholars to the historical data contained in the ancient Páli buddhistical records, as exhibited in the Mahâwanso; contrasted with the results of their profound researches, as exhibited in their various publications and essays, commencing from the period when Sir W. Jones first brought oriental literature under the scrutiny and analysis of European criticism.

" Half a century has elapsed since that eminent person formed the Bengal Asiatic Society, which justly claims for itself the honor of having " numbered amongst its members all the most distinguished students of oriental literature, and of having succeeded in bringing to light many of the hidden stores of Asiatic learning." Within the regions to which their researches were in the first instance directed, the prevailing religion had, from a remote period, extending back, perhaps, to the christian era, been hinduism. The priesthood of that religion were considered to be exclusively possessed of the knowledge of the ancient literature of that country, in all its various branches. The classical language in which that literature was embodied was Sanscrit.

" The rival religion to hinduism in Asia, from a period too remote to admit of chronological definition, was buddhism. The last successful struggle of buddhism for ascendancy in India, was in the fourth century before the christian era. It then became the religion of the state. The ruler of that vast empire was, at that epoch, numbered amongst its most zealous converts; and fragments of evidence, literary, as well as of the arts, still survive, to attest that that religion had once been predominant throughout the most civilized and powerful kingdoms of Asia. From thence it spread to the surrounding nations; among whom, under various modifications, it still prevails.

" Hinduism, as the religion at least of its rulers, after an apparently short interval, regained its former ascendency in India; though the numerical diminution of its antagonists would appear to have been

more gradually brought about. Abundant proofs may be adduced to shew the fanatical ferocity with which these two great sects persecuted each other,—a ferocity which mutually subsided into passive hatred and contempt, only when the parties were no longer placed in the position of actual collision.

"European scholars, therefore, on entering upon their researches towards the close of the last century, necessarily, by the expulsion of the buddhists, came into communication exclusively with hindu pundits; who were not only interested in confining the researches of orientalists to Sanscrit literature, but who, in every possible way, both by reference to their own ancient prejudiced authorities, and their individual representations, laboured to depreciate in the estimation of Europeans, the literature of the buddhists, as well as the Páli or Mágadhi language, in which that literature is recorded.

"The profound and critical knowledge attained by the distinguished Sanscrit scholars above alluded to, has been the means of elucidating the mysteries of an apparently unlimited mythology; as well as of unravelling the intricacies of Asiatic astronomy, mathematics, and other sciences,—of analysing their various systems of philosophy and metaphysics,—and of reducing tracts, grammatical as well as philological, into condensed and methodised forms; thereby establishing an easier acquirement of that ancient language, and of the varied information contained in it.

"The department in which their researches have been attended with the least success, is History; and to this failure may perhaps be justly attributed the small portion of interest felt by the European literary world in oriental literature. The progress of civilization in the west has, from age to age, nay, from year to year, added some fresh advancement or refinement to almost every branch of the arts, sciences, and belles lettres; while there is scarcely any thing, as hitherto developed in Asiatic literature, which could be considered either as an acquisition of practical utility to European civilization, or as models for imitation or adoption in European literature.

"In the midst, nevertheless, of this progressively increasing discouragement, the friends of oriental research have proportionately increased their exertions, and extended the base of their operations. The formation of the Royal Asiatic Society of Great Britain and Ireland, and of similar institutions on the continent of Europe; and the more rapid circulation of discoveries made in Asia, through the medium of the monthly journal of the Asiatic Society of Bengal, during the last four years, afford undeniable proofs of unabated exertion in those researches. To those who have watched the progress of the proceedings of these institutions, no small reward will appear to have crowned the gratuitous labours of orientalists. In the pages of the

Asiatic Journal alone, the decyphering of the alphabets in which the ancient inscriptions scattered over Asia are recorded, (which is calculated to lead to important chronological and historical results); the identification and arrangement of the ancient coins found in the Punjab; the examination of the recently discovered fossil geology of India; the analysis of the Sanscrit and Tibetan buddhistical records, contained in "hurdreds of volumes," by professor Wilson; and the translation of the hindu plays, by the same distinguished scholar;—exhibit triumphant evidence, that at no previous period had oriental research been exerted with equal success. Yet it is in the midst of this comparatively brilliant career, and at the seat of the operations of the Bengal Asiatic Society, that the heaviest disappointment has visited that institution. It has within the last year been decided by the Supreme Government of India, that the funds which "have hitherto been in part applied to the revival and improvement of the literature, and the encouragement of the learned natives of India, are henceforth to be appropriated to purposes of English education." In an unavailing effort of the Asiatic Society to avert that decision, the Supreme Government has thought proper to designate the printing of several standard oriental works, then in progress, to be 'to little purpose but to accumulate stores of waste paper.'

" I advert not to these recent discussions in Bengal with any view to take part in them. My object is exclusively to show that the increasing discouragement or indifference evinced towards oriental research, does not proceed either from the exhaustion of the stores to be examined, or from the relaxation of the energy of the examiners; and to endeavour to account for the causes which have produced these conflicting results.

" The mythology and the legends of Asia, connected with the fabulous ages, contrasted with those of ancient Europe and Asia Minor, present no such glaring disparity in extravagance, as should necessarily lead an unprejudiced mind to cultivate the study and investigation of the one, and to decide on the rejection and condemnation of the other. Almost every well educated European has exerted the first efforts of his expanding intellect to familiarize himself with the mythology and fabulous legends of ancient Europe. The immortal works of the poets which have perpetuated this mythology, as well as these legends, have from his childhood been presented to his view, as models of the most classical and perfect composition. In the progress to manhood, and throughout that period of life during which mental energy is susceptible of the greatest excitement,—in the senate, at the bar, on the stage, and even in the pulpit,—the most celebrated men of genius have studiously borrowed, more or less of their choicest ornaments, from the works of the ancient poets and historians.

" To those, again, to whom the fictions of the poets present no

attractive charms, the literature of Europe, as soon as it emerges from the darkness of the fabulous ages, supplies a separate stream of historical narration, distinctly traced, and precisely graduated, by the scale of chronology. On the events recorded and *timed* in the pages of that well attested history, a philosophical mind dwells with intense interest. The rise and fall of empires; the origin, growth, and decay of human institutions; the arrest or advancement of civilization; and every event which can instruct or influence practical men, in every station of life, are there developed, with the fullest authenticity. Whichever of these two departments of literature—fiction or fact—the European student may find most congenial to his taste, early associations and prepossessions have equally familiarized either to his mind.

"As regards oriental literature, the impressions of early associations never can, nor is it to be wished that they ever should, operate on the European mind. Even in Europe, where the advantage of the spread of education, and of the diffusion of useful knowledge, are the least disputed of the great principles which agitate the public mind, there are manifest indications that it is the predominant opinion of the age, that into the scheme of that extended education—more of fact and less of fiction—more of practical mathematics and less of classics—should be infused, than have hitherto been adopted in public institutions. *Mutatis mutandis*, I regard the recent Indian fiat "that the funds which have hitherto been in part applied to the revival and improvement of the literature, and the encouragement of the learned natives of India, shall be exclusively appropriated to purposes of *English* education," to be conceived in the same spirit.

"These early associations, then, being thus unavailing and unavailable, (if the foregoing remarks are entitled to any weight) the creation of a *general* interest towards, or the realization of the subsiding expectations, produced at the formation of the Bengal Asiatic Society, in regard to, oriental literature, seems to depend on this single question; namely,

"*Does there exist now, or is there a prospect of an authentic history of India being developed hereafter, by the researches of orientalists?*

"On the solution of this question, as it appears to me, depends entirely, whether the study of oriental literature (with reference not to languages, but the information those languages contain) shall continue, like the study of any of the sciences, to be confined to the few whose taste or profession has devoted them to it; or whether it shall some day exercise an influence over that more extended sphere, which belongs to general history alone to exert.

"This is an important, though not, perhaps, altogether a vital, question:—important, more especially at the present moment, as regards the interest it can create, and the resources it can thence derive, for the purpose of extending the basis of research ; but not vital, inasmuch

as there is no more reason for apprehending the extinction of oriental research, from its having failed to extend its influence over the whole educated community of the world, than that geology, mineralogy, botany, or any of the other sciences should become extinct, because the interest each individually possesses is of a limited character. Nor does the continuance of oriental research, conducted by Europeans, appear, in any degree, to depend on the contingency of the permanence of British sway over its present Asiatic dominions; for the spirit of that research has of late years gained even greater strength on the continent of Europe than in the British empire." Page xxi—xxvi.

The next extract adverts to the question of antiquity as regards the *Mágadhi* or Pali language.

" In the midst of this interesting and triumphant career of oriental research, I have undertaken the task of inviting the attention of orientalists to the Pàli buddhistical literature *of India*, the examination of which is not within my own reach. If they are found to approximate, in any degree, to the authenticity of the Pàli historical annals *of Ceylon*, we shall not only be able to unveil the history of India from the sixth century before Christ, to the period to which those annals may have been continued in India; but they will also serve to elucidate there, as they have done here, the intent and import of the buddhistical portions of the inscriptions now in progress of being decyphered.

" To do justice, however, to the important question under consideration, I must briefly sketch the history of the Màgadhi or Pàli language, and the scheme of buddhism in reference to history, as each is understood in Ceylon.

" Buddhists are impressed with the conviction that their sacred and classical language, the Màgadhi or Pàli, is of greater antiquity than the Sanscrit; and that it had attained also a higher state of refinement than its rival tongue had acquired. In support of this belief they adduce various arguments, which, in their judgment, are quite conclusive. They observe, that the very word " Pàli" signifies, original, text, regularity; and there is scarcely a buddhist Pàli scholar in Ceylon, who, in the discussion of this question, will not quote with an air of triumph, their favorite verse,—

" *Sá Mágadhi; múla bhásá, naráyéyádi kappiká, brahmánóchássuttálápa, Sambuddháchápi bhásaré.*

" 'There is a language which is the root (of all languages); men and bráhmans at the commencement of the creation, who never before heard nor uttered an human accent, and even the supreme Buddhos, spoke it: it is Mágadhi.'

"This verse is a quotation from Kachcháyano's grammar, the oldest referred to in the Páli literature of Ceylon. The original work is not extant in this island. I shall have to advert to it hereafter.

"Into this disputed question, as to the relative antiquity of these two ancient languages, it is not my intention to enter. With no other acquaintance with the Sanscrit, than what is afforded by its affinity to Páli, I could offer no opinion which would be entitled to any weight. In abstaining, however, from engaging in this discussion, I must run no risk of being considered a participator in the views entertained by the Ceylon buddhists; nor of being consequently regarded in the light of a prejudiced advocate in the cause of buddhistical literature. Let me, therefore, at once avow, that, exclusive of all philological considerations, I am inclined, on *primâ facie* evidence—external as well as internal—to entertain an opinion adverse to the claims of the buddhists on this particular point. The general results of the researches hitherto made by Europeans, both historical and philological, unquestionably converge to prove the greater antiquity of the Sanscrit. Even in this island, all works on astronomy, medicine, and (such as they are) on chemistry and mathematics, are exclusively written in Sanscrit. While the books on buddhism, the histories subsequent to the advent of Gotamo Buddho, and certain philological works, alone, are composed in the Páli language." Page xxxix—xli.

As a specimen of the style of translation of the *Mahawanso* as well as of the work itself, the 12th chapter is extracted, as it relates to the various embassies for the promulgation of *Buddhism*.

"Chap. xii.—The illuminator of the religion of the vanquisher, the thero son of Moggali, having terminated the third convocation, was reflecting on futurity. Perceiving (that the time had arrived) for the establishment of the religion of Buddho in foreign countries, he dispatched severally, in the month of "Kattiko," the following theros to those foreign parts.

"He deputed the thero Majjhantiko to Kasmira and Gandhara, and the thero Mahadevo to Mahisamandala. He deputed the thero Rakkhito to Wanawasi, and similarly the thero Yona-Dhammarakkhito to Aparantaka. He deputed the thero Maha Dhammarakkhito to Maharatta; the thero Maharakkhito to the Yona country. He deputed the thero Majjhimo to the Himawanta country; and to Sowanabhumi, the two theros Sono and Uttaro. He deputed the thero Maha-mahindo, together with his (Moggali's) disciples, Ittiyo, Uttiyo, Sambalo, Bhaddasalo (to this island), saying unto these five theros, "Establish ye in the delightful land of Lanka, the delightful religion of the vanquisher."

"At that time, a savage naga king named Aravalo, who was endowed with supernatural powers, causing a furious deluge to descend, was submerging all the ripened crops in Kasmira and Gandhara.

The said thero Majjhantiko, instantly repairing thither through the air, and alighting on the lake Aravalo, walked, absorbed in profound meditation, on the surface of the water. The nagas seeing him, enraged (at his presumption), announced it to their king. The infuriated naga monarch endeavoured in various ways to terrify him: a furious storm howled, and a deluge of rain poured down, accompanied by thunder; lightning flashed in streams; thunder-bolts (descended) carrying destruction in all directions; and high peaked mountains tottered from their very foundations.

" The nagas assuming the most terrific forms, and surrounding him, endeavoured to intimidate him. He himself (the naga king) reviling him in various ways, spit smoke and fire at him. The thero by his supernatural power averted all these attempts to terrify him ; and displaying his omnipotence, thus addressed the naga monarch : " O, naga ruler ! even if the devos were to unite with the (human) world to strike terror into me, their efforts would prove nugatory. Nay, if uplifting the whole earth, together with its ocean and its mountains, thou wert to keep them on my head, even then thou wouldest fail to create in me an appalling terror. O, naga monarch, let thy destruction of the crops be arrested."

" To him who had been subdued on hearing this reply, the thero propounded his doctrines. Whereupon the naga king attained the salvation and state of piety of that faith.

" In like manner, in the Himawanta (or snowy) regions, eighty-four thousand nagas, and many gandhabbos, yakkhos, and kumbhandakos (were converted).

" A certain yakkho called Panchako, together with his wife Harita and five hundred youths, attained sowan (the first stage of santification). He then thus addressed them : " Do not hereafter, as formerly, give way to pride of power, and vindictive anger ; but evincing your solicitude for the happiness of living creatures, abstain from the destruction of crops : extend your benevolence towards all living creatures : live, protecting mankind." They who had been thus exhorted by him, regulated their conduct accordingly.

" Thereupon the naga king placing the thero on a gem-set throne, respectfully stood by, fanning him.

" On that day, the inhabitants of Kasmira and Gandhara, who had come with offerings to the naga king (to appease his wrath and arrest the desolation of the crops), learning the supernatural character of the thero, bowing down to him (instead of the naga king), stood reverentially at his side.

" The thero preached to them the " asivisopaman" discourse (of Buddho). Eighty thousand persons attained superior grades of religious bliss : one hundred thousand persons were ordained priests by the thero.

" From that period, to the present day, the people of Kasmira and Gandhara have been fervently devoted to the three branches of the faith, and (the land) has glittered with the yellow robes (of the priests).

" The thero Mahadevo repairing to the Mahisamandala country, in the midst of the population preached to them the " dewadutta" discourse (of Buddho). Forty thousand persons became converts to the faith of soverign supremacy ; and by him forty thousand (more) were ordained priests.

" Thereafter, the thero Rakkhito, repairing to the Manawasa country, poising himself in the air, in the midst of the populace preached the " anomatugga" discourse (of Buddho). Sixty thousand persons attained the sanctification of the faith ; and by him thirty seven thousand were ordained priests. The said thero constructed five hundred wiharos in that land, and there he also established the religion of the vanquisher.

" The thero Yonako Dhammarakkhito repairing to the Aparantaka country, in the midst of the populace preached the " aggikkhandopaman" discourse (of Buddho). This (disciple), who thorougly understood how to discriminate true from false doctrines, poured out to the seventy thousand who had assembled before him the delicious (draught of the) true faith. A thousand males and a still greater number of females, descendants exclusively of Khattiya families, impelled by their religious ardour, entered into the priesthood.

" The sanctified disciple Maha-Dhammarakkhito repairing to Maharatta, there preached the " mahanaradakassapo jatako" (of Buddho). Eighty four thousand persons attained the sanctification of " magga," and thirteen thousand were ordained priests by him.

" The sanctified disciple Maharakkhito repairing to the Yona country, in the midst of the populace preached the " kalakarana" discourse (of Buddho). One hundred and seventy thousand living beings attained the sanctification of " magga" and ten thousand were ordained.

" The sanctified disciple Majjhimo, with four other theros (Kassapo, Malikadevo, Dhundadhinnosso and Sahasadevo), repairing to the land of Himawanto, preached there the " dhammachakko" discourse (of Buddho). Eighty koti of living beings attained the sanctification of the " magga." These five theros separately converted the five divisions (of Himawanto).

" In the fraternity of each of these theros, one hundred thousand persons, impelled by the fervour of their devotion to the religion of the omniscient supreme Buddho, entered into the order of the priesthood.

" Accompanied by the thero Uttaro the disciple Sono repaired to Sowanabhumi.

" In those days, as soon as an infant was born, a marine monster emerging from the ocean, devoured it and disappeared. At the parti-

cular period (of this mission), a prince was born in a certain palace. The inhabitants seeing the priests, and taking them to be the emissaries of this rakkhasi, arming themselves, surrounded them for the purpose of destroying them. The theros having ascertained what their object was, thus addressed them : " We are pious ministers of religion, and not the emissaries of the rakkhasi." The monster with her train at this instant emerged from the ocean. Hearing of this (visitation), this concourse of people gave a great shout of horror. The thero causing (by his power of working miracles) another band of terrifying monsters to spring up, of double that numerical power, surrounded the rakkhasi and her train on all sides. She, concluding " this land has been appropriated by these," terrified, fled. Establishing the protection of the true faith over that land in all quarters, in that assembly the thero preached the " brahmajala'' discourse (of Buddho). A great multitude of people attained the salvation and the state of piety of that faith.

" Sixty lacks became eminently endowed with the knowledge of its doctrines. Two thousand five hundred men became priests, and one thousand five hundred women, of various castes, were admitted into the priesthood.

" From that period, the princes born in that palace obtained (from Sono and Uttaro) the name of Sonuttaro.

" These (disciples, following the example) of the all-compassionating vanquisher's resignation (of his supreme beatitude), laying aside the exalted state of happiness attained by them, for the benefit of mankind undertook these missions to various countries. Who is there who would demur (when) the salvation of the world (is at stake) ?

" The twelfth chapter in the Mahawanso, entitled, " the conversion of the several foreign countries," composed both to delight and to afflict righteous men." p. 78—82.

The foregoing extracts convey confessedly an imperfect idea of a work which cannot but be one of much interest to the orientalist ; and at the least estimate, a curiosity to the reading world at large.

The present volume of Mr. Turnour, is, however, put forth to enable him to ascertain whether oriental scholars approve of his undertaking, as may be gathered from the following paragraph of the Introduction :

" The whole publication will occupy two volumes quarto ; but I shall not commence on the second, till I am satisfied, by the opinion expressed by orientalists on this pamphlet, that I have not, in my unassisted judgment, been led to overrate the value of the " Maháwanso" generally. A glossary and a map will be published with the First Volume."

Our own judgment of the value of the work, may be gathered from

the foregoing observations: and we entertain a strong desire to see the translation completed, and hope that Mr. Turnour will experience the aid and support from literary men which his meritorious labours in the cause of oriental literature so abundantly merit.

2.—*Illustrations of the Botany, and other branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere.—By* J. F. Royle, Esq., F. L. S., F. G. S., *&c. of the H. E. I. C. Medical Establishment.*

We notice this important work again, not for the purpose of making any critical remarks, for we should only have to reiterate our expressions of praise and commendation, but to enable us to lay before our readers several highly valuable extracts, relating to various products of India, which will be interesting and important, not only to the scientific botanist, but to the physician, the merchant and agriculturist, and to the Government of the country, likewise, as means are indicated by which the natural products of India may be improved and multiplied, its commerce, consequently, augmented, the government and people reciprocally benefitting.

Since our last issue, the ninth number of Mr. Royles' work has reached us, from which chiefly the following extracts are made:

"In the introductory observations, it has been stated, that in the cold weather of Northern India, or from October to March, the annuals of Europe, whether used as vegetables or as medicines, could be successfully grown; while in the mountains, the same plants found a congenial climate from April to October. Accordingly, at these stations in the respective seasons, *Henbane, Datura, Stramonium,* and *Nicandra indica,* were successfully grown, and afterwards converted into extract for experiment, and subsequently for the medical depôts. The extract of *Henbane* particularly was highly approved of by several medical officers, and pronounced by Mr. Twining, after trial in the General Hospital of Calcutta, to be of "most excellent quality." In the same places and seasons, the Belladonna, Foxglove, and Hemlock, could be equally well grown, with many other plants requiring a similar climate.

"But a plant, second hardly to any in point of importance in furnishing food for man, requiring also the same climates, has been introduced into the same countries. This is the potato, for which India as well as the rest of the Old World, is indebted to the New World. It has been found in a wild state, in 33° of S. latitude, in Chili, in the mountains near Valparaiso and Mendoza, and also near Lima, Quito, and Santa Fé de Bagota; but in these situations it is supposed to have es-

caped from a state of cultivation, as the illustrious Humboldt argues that it must have travelled north in 'the course followed by the Incas in their conquests.' But as it was introduced into England from Virginia in 1586 by Sir W. Raleigh, and not known to the Mexicans in the time of Montezuma, he concludes it as probable, that if the English colonies did not receive it from South America, this plant was originally wild in some country of the northern hemisphere, as it was in Chili. This conjecture has been singularly confirmed by the potato being found wild on the Pic d'Orizaba by Deppe and Schiede. *(D. Don)*.

" The potato, we are informed by Dr. Ainslie, was introduced into India from the Cape of Good Hope, and some of excellent quality are produced in the Mysore country, particularly at Bangalore and Nundydroog. They are grown all over India (Roxb.), and of a very fine quality in the cold weather, or from October to March, along the plains of India from Patna to Loodiana. Dr. Wallich states, that 'they are planted in the valleys and lower hills of Nepal, so as to afford fresh crops all the year round : the roots are planted in February, June, and November, and gathered after three months.' They were introduced into the northern mountains, and grown in the neighbourhood of Simla, at an elevation of near 7,500 feet ; and by Major Young, on the mountains north of Deyra, at an elevation of 6,700 feet; so that Mussooree made its first appearance on the map by the name of the Potato Garden. Their quality was subsequently much improved by Captain Townsend raising some from seed, which in the third year became of enormous size, and of very good quality. They are now becoming very generally cultivated, both in the hills and plains of Northern India ; and it is fortunate both for sellers and consumers, that those grown in the former come in when the others are going out of season. Potatoes are in some places becoming adopted as food by the natives of India, though more slowly than could be wished ; at this we need not be surprised, as even in France their use was not generally adopted until after their introduction into Europe more than two hundred years, and then only owing to the persevering efforts of the philanthropic Parmentier, round whose tomb, in Pere la Chaise, they are now yearly planted: so that M. Fée remarks, 'verité frappante, toujours repetée et toujours nouvelle : il faut déployer plus d'activité et plus de ressources d'esprit pour faire du bien aux hommes que pour leur nuire.'

" Indebted as India is to the New World for the capsicum and potato, there is yet another plant, which, though not to be compared with the last in real importance, is still more valuable as an article of commerce. This is the Tobacco, which from being the solace only of the red American, has become one of the luxuries of the rich, and almost a necessary of life for the poorer inhabitants of a great portion of the globe. The Hindoo, slow to adopt strange customs, has been caught

with the general infection; and though some religiously abstain from its use, their nobles, as their women, may be seen inhaling it in the midst of perfumed essences, while the labouring bearer and hard-working boatman seem to derive fresh vigour from their ever-in-hand hooqqas: the mountaineer, finding it inconvenient to carry such an apparatus over his rugged roads, makes a hole in the ground, through which he smokes.

" The Spaniards are said to have first become acquainted with the tobacco in the West Indies. The name by which it is now known was that used in the Haytian language to designate the pipe used in smoking the herb, which by the Mexicans was called *yetl*, and by the Peruvians *sayri* (Humboldt). It was first cultivated near Lisbon about 1560; and introduced into England in 1586 by Sir Walter Raleigh and his companions. It early attracted the notice of the English settlers in Virginia, especially after the founding of James Town in 1607. Shortly after this, it appears that tobacco was introduced in lieu of specie, as the tavern-keepers were compelled to exchange a dinner for a few pounds of tobacco, and government officers were paid in the same commodity (Tatham, p. 180); Malte Brune, quoting from Morse, states that, about 1619, on the arrival of a fresh body of emigrants, 150 young women were sold to the planters as wives, at 150lbs. of tobacco each. In the native annals tobacco is described to have been first taken to Java in 1601. In Persian works on Materia Medica, it is stated to have been introduced into India in A. H. 1014 (A. D. 1605) towards the end of the Sultunnut of Jelaladeen Akbar Padshaw. This is confirmed by a proclamation of Jehangeer, who succeeded in July of that year. From India tobacco was probably taken to the Malayan peninsula, and perhaps to China; but Pallas, Rumphius, and Loureiro, are of opinion that in China the use of tobacco is more ancient than the discovery of the New World.

" As tobacco is now extensively cultivated both in the Old and New World, it will be proper, if we wish to obtain an idea of the climate best suited to it, to ascertain that of the places where the best kinds are grown. The species referred to the genus *Nicotiana* are twenty-six in number in the Syst. Vegetabilium of Rœmer and Schultes. Of these, some are doubtful and others probably only varieties; so that one-fifth may be safely deducted from the above number. The remainder are indigenous in America from Brazil and Chili, along Peru, to Mexico and the rocky mountains on the north. One species, *N. Australasiæ*, R. Brown Congo, p. 472 (*suaveolens*, Lehm., *undulata*, Bot. Mag. 673) is undoubtedly wild in New Holland, in the neighbourhood of Port Jackson. *N. persica*, of Dr. Lindley, affording the fine Shiraz tobacco, is supposed to be so in Persia and *N. chinensis*, in China.

" The species most generally cultivated is *N. Tabacum.* The seeds of *N. repanda*, Bot. Mag., t. 2484, were given to Mr. G. Don, as that of the species from which the small Havannah Cigars are manufactured; but smokers find little difference in flavour between these and the larger kind. *N. multivalvis*, Bot. Reg. t. 105, is cultivated by the Indians who inhabit the banks of the Columbia, while those of the rocky mountains and of the banks of the Missouri, prepare their tobacco from *N. quadrivalvis*, Bot. Mag. t. 1778, and *N. nana*, Bot. Reg. t. 883, which are allied to the former. *N. rustica* is chiefly cultivated in Western Africa (Mr. G. Don), as well as in Egypt, according to Mr. J. Bennet, from specimens brought by Mr. Wilkinson. Mr. D. Don informs me that it also affords the tobacco of Salonica (the ancient Thessalonica); probably also that of Latakkia (Laodicea), which is so much esteemed. It is also cultivated in the north of Germany, Russia, and Sweden; according to Mr. Loudon, with *N. tabacum*, near Utrecht and Guelders; and a variety of it in Ireland. From Parkinson we learn, that it was the kind preferred by Sir W. Raleigh.

" In taking a view of the climate suited to the cultivation of any of these species, nothing so much excites astonishment as to find a plant, which with rice, sugar, cocoa, coffee, and cotton, attains great perfection in tropical regions, also successfully cultivated in the northern climates of Sweden and Scotland. This is owing to its being a plant requiring only a few months to bring it to perfection, and therefore finding the summer temperature of many countries suffice for its cultivation; but it is still remarkable to find tobacco cultivated with equal success in Cumana and in Maryland.

" The cultivation of tobacco in North America for foreign commerce, is chiefly carried on in Virginia and Maryland, or almost from 35° to 40° of northern latitude. The climate of America, as we have seen when treating of the cultivation of tea, p. 113, is like that of China, subject to great vicissitudes between winter and summer, but the latter only being that with which we have any concern in the cultivation of an annual plant, it is sufficient to mention, that according to the illustrious Humboldt, the mean temperature of Williamsbourg in N. lat. 38° 8′ is 58°, and of Philadelphia in N. lat. 39° 56′ is 54° and the mean temperature of summer in the latter, 73° 94.′ The other places which are celebrated for their tobacco, are Havannah, lat. 23° 10′, mean temperature of year, 78°. 08; of summer, 83°. 3: Vera Cruz, lat. 19°. 11′ M. T. 78°. 08; and Cumana, lat. 10°. 27′ M. T. 81°. 86; S. T. 83°. 7. But as these much exceed the summer temperature of northern places where it is grown, as of Stockholm, 61°. 88; Dublin, 59°. 54; Edinburgh, 58° 28; it will be necessary to inquire, whether there are any peculiarities of climate in the places where tobacco is actually grown. But here we shall meet with considerable difficulties in ascertaining

what are all the desiderata with respect to the successful cultivation of tobacco, as almost of every other plant; for colonial cultivators in the accounts which they have published, so seldom give any good account of the climate in which their experiments have been made, that we find it almost impossible to ascertain what are the states of dryness or moisture of the atmosphere, what the nature of the winds, what the proportions between the richness of a soil and the dryness of the air, or even what the temperature during the different processes; for upon all these must depend both the growth of the plant and the nature of its secretions, as already pointed out in the article on the cultivation of cotton, p. 88.

"But from the notices procurable from other sources, and especially the works of the illustrious Humboldt, it appears that though tobacco be exported from very hot places in the Gulph of Mexico, it is only grown on elevated ground in the vicinity of Vera Cruz, Cumana, and Havannah, where, as will be seen in the accompanying notes,* a very slight elevation is sufficient to produce a modification of temperature, as well as a constant circulation and comparative dryness of the atmosphere; for as the lower strata become heated, they expand, and necessarily ascend; the capacity of air for moisture as for heat being

"* The island of Cuba, lying between N. lat. 23° 15′ and 19° 48′, only seventy miles in breadth, and everywhere pervaded by mountain ridges, must necessarily have its climate modified by these, as well as by its insular situation; that is described as dry and warm, but more temperate and healthy than that of other W. I. islands. Moreover according to Humboldt, 'the influence of localities, of which the study is of so much importance to the cultivator, as the great breadth of the New Continent, the proximity of Canada, the winds which blow from the north, and other causes, give the equinoctial region of Mexico and the island of Cuba, a particular character. One would say, that in these regions the temperate zone, the zone of variable climates, increases towards the south, and passes the tropic of Cancer. In the environs of Havannah (lat. 23° 8′) the thermometer has been seen to descend to the freezing point, at the small elevation of 262 feet above the level of the ocean, and snow has fallen near Valladolid (lat. 19° 42′) at an absolute elevation of 6,232 feet, while under the equator, this only takes place at double the elevation.' (Pol. Hist. of New Spain, II. p. 362).

"In Mexico, the intendancy of Guadalaxara, which must participate in the causes affecting the climate of Valladolid, was celebrated for the abundance and excellent quality of the tobacco which was produced. The cultivation is now restricted to the environs of Orizaba and Cordoba, and the partidos of Huatusco and Songolica in the intendancy of Vera Cruz. (Humboldt, III. p. 40). The towns are situated on the eastern declivity of the Pic d'Orizaba, and on the road to Xalappa, which, as elevated 7,719 feet, enjoys a cool and agreeable climate; that of Cordoba is warmer, but much cooler than that of Vera Cruz, and from its situation must have a freer circulation of air.

"Cumana is noted for the purity and healthiness of its climate, and the great heat incident to the situation being moderated by the sea breeze. 'Cumanacoa, fourteen leagues S. E. of Cumana, is a rich plain, surrounded by lofty mountains, and although only 630 feet above the sea, possessed of a mild and even cold climate. Its environs supply the province with tobacco.'—*Enc. Metrop.*

"Bahia, also celebrated for its tobacco, which was exported not only into Spain, but into Africa, and the South American States, has also any excessive heat of climate moderated by the sea breeze."

in proportion to its rarefaction ; this, with coolness, will also produce dryness, which favours evaporation from the surface of leaves. Mr. Loudon has succinctly stated the requisites for obtaining good tobacco. 'In hot, dry, and short summers, the tobacco is small, but of delicate quality and fine flavour ; in long moist and not very warm summers, it will grow large, but be without that fine flavour, which can only be given by abundance of clear sun-shine and free dry air. In the north of Germany, he adds, a good wine year, which depends on warmth and dryness, is always a good tobacco year ;' and it may be inferred, that the combination of heat with moisture, will, in this, as in other plants to which it is not fatal, produce great extension of the parts of vegetation with coarseness of fibre, perhaps also of flavour.

"Tobacco has been introduced into the Old World, and produced of such excellent quality, over so wide an extent of latitude, as to prove that in properly selected sites, and with the care bestowed on it in America, it may be grown of as fine quality in many parts of the Old Continent. Thus we find it cultivated in the islands of the Indian Archipelago and in Java. Manilla has long been celebrated for its tobacco; Niebuhr describes it as very fine; many smokers prefer Manilla cheroots to any other. Here the climate, though the Philippines are situated under the Line, is described as excellent, in consequence of the height of the mountains, and the regularity of the sea breezes.

"The next tobacco which has obtained a European reputation, is that of Darabjird in Fars : of this locality it is sufficient to state, that it is in the neighbourhood of Shiraz, in 30° of N. latitude, and situated on the table-land of Persia; that the climate, though hot, is dry, and as celebrated for its wine as for its tobacco. This has been ascertained by Dr. Lindley to be the produce of his *N. persica* (Bot. Mag. t. 1592); but whether it be a native of Persia is less certain, as the Persians have no other name for it than *tumbakoo ;* and the careful culture and cure make one suspect that it was introduced by the Portuguese when in possession of Ormuz. Still further north, the tobacco commonly called Turkish, produced by *N. rustica*, and grown on the coasts of the Mediterranean, is highly valued. But the Dutch, which is compared to the Maryland, and like it grown in the highest latitudes, is also much esteemed, chiefly owing to its careful culture and preparation ; for the tobacco of the south of France is intrinsically better, but less carefully prepared (Loudon). It is lamentable to exclude India entirely from this enumeration; but whether this be owing to a defect of climate or of culture, is not yet apparent ; or whether in consequence of the large consumption of what is good, the inferior kinds only find their way to the export market : but there is no doubt that East India tobacco holds the lowest place in the English market, and is described as being too

high dried, or as all stalk and powder, fit only for the inferior kinds of snuff, or for re-exportation. The inconveniences of this are not so much experienced in India as elsewhere, for both natives and Europeans use the tobacco for their hooqqas, only when beat up with molasses, conserves, and spices.

"That it is not owing to any inherent defect in the climate of the British possessions in India, that the tobacco is of such inferior quality, I am happy to be able to prove by extracts from official documents, with which, owing to his kindness and anxiety to assist in improving the resources of India, I have been favoured by Mr. William Johnson, of the East-India House. First, with respect to that which obtained considerable repute under the name of Martaban tobacco, Dr. Wallich states, that 'the sort is from Arracan and not from Martaban;' and describes it as having 'a fine silky leaf: tried by many people, it had been pronounced the very best they had ever tasted, equal to, nay, surpassing the finest imported from Turkey and Persia.' An extensive tobacconist says, 'a finer and better flavoured tobacco he never saw or tasted in his life.' One of the first brokers in the city says, 'the sample of leaf tobacco is certainly of a very fine quality, and appears to have been produced from some peculiar seed, and a greatly improved cultivation and cure.' By many manufacturers 'it was supposed to be from the seed of Havannah or St. Domingo tobacco.' For smoking, it is compared with Maryland tobacco, having the same qualities, 'except the flavour, which is better, and more like Havannah.' The colour and leaf are moreover pronounced excellent for cigar-making; 'but if any thing is against it for that purpose, it is the largeness of the principal stalk, and coarseness of the small fibres in the leaf.' The commercial gentleman by whom the tobacco was transmitted to the brokers, pronounces it very superior, and the leaf as very fine, adding, that the price of 6*d.* or 8*d.* might readily be obtained, perhaps more, with the improvements suggested.

"As it is interesting, if possible, to ascertain the peculiarities of climate and country where so superior an article is grown, we have a communication from Mr. R. Hunter, the gentleman who brought the tobacco from Arracan, who states that 'the Sandoune tobacco grows on the sloping banks of rivers not overflowed while the crop is on the ground, but inundated during the rains. The best is that grown above the influence of the tides, about thirty miles from the mouth of the river. The ground receives apparently great attention in cleaning and in breaking the clods. The tobacco is all transplanted about November, and the crops are cut about March.' Here we see the coldest season is selected for the cultivation: with respect to climate, it may be inferred from the province of Arracan extending along the western side of the Bay of Bengal, and included between the coast and a range

of mountains, that it must have alternations of temperature, and of land and sea breezes; and that though Arracan Proper is low, inundated, and shut in by low hills, at Bassein the climate is described as neither oppressive nor unhealthy from November to May (Encl. Met. Pegu), and Sandoway as mountainous, and not subject to inundations, enjoying a cool sea breeze, and temperate nights nearly through the year. It is however, probable, that the superiority of the tobacco is owing to careful cultivation and cure. This was probably taught by Europeans, as Arracan was the seat of a Roman Catholic mission in the beginning of the seventeenth century. It is pleasing to find here, as in the vicinity of Ormuz, the arts continuing to benefit a country long after the conquests of those who introduced them have passed away.

"Of other tobaccos which have some repute in India, Dr. Ainslie states, that 'the finest kinds in India, and perhaps in the world, is grown near the village of Woodanum, in the Northern Circars,' 'and in some of those low sandy islands formed at the mouth of the river Krishna (from which is made the famous Masulipatam snuff); also in the Delta of the Godavery, where the soil is peculiarly rich and fertile.' Dr. Wallich, in his evidence before the Committee of the House of Commons, states that some excellent tobacco was grown at Boglipore, from Havannah seed, and that some very esteemed kind is grown in Bundelcund. The tobacco of Chunar is celebrated in India, as is more especially that of Bhilsa, of which a great portion I am informed by Dr. Moore, is sent away in presents by the Rajah of Nagpore. It is to be regretted that we are unable to ascertain the commercial value of any of these, as they do not appear to have been sent to the English market. The only exception is that mentioned by Mr. Ritchie, of one bale of the fine tobacco grown in the northern districts of Bombay, selling for 6*d.*, while American sold for 5*d.*; but the average of the experimental exportation being found defective in the curing, sold only for 1*d.* and 2*d.*, and did not pay, as is frequently the case with importations of tobacco from Bengal and Bombay.

"Such appears to have been the state of the ordinary Indian tobacco, when the East India Company determined on endeavouring to induce cultivators to improve the culture of tobacco by importing seed from Maryland and Virginia, which was to be freely distributed to those inclined to make experiments on the subject.

"These experiments, I regret to say, seem, with one exception, to have been undertaken only in the southern parts of India, at least it is from thence only that samples have been sent to the India House. Importing seed from 35° to 40°, and with territory from 8° to 32° of north latitude, elevated from 0 to 13,000 feet above the sea, it is great-

ly to be lamented that experimenters should have been confined to between 12° and 16°, that is, to the districts of Cuddapah, Guntoor, and Coimbatore. The object being to get an article similar in properties to that already esteemed in the market: the plan would be to make the first attempts, as failure is so apt to discourage, in the soil and climate most like that whence seed is procured. Though the above districts may by a different treatment be enabled to grow very good tobacco, there is no doubt that the soil was either too rich for the Virginia seed, or the climate too moist and warm, or perhaps both conjoined, for the plants have grown so luxuriantly, that the stalks and fibres have attained a size and coarseness, fitting them better for twisting into cables than for putting into a pipe. One cultivator, indeed, states that the plants grew so well, as to be twice the size of the country plants. The tobacco was besides so badly packed, and worse cured, that the brokers describe the different samples as 'too dark in colour,'—'thick and coarse grown,'—'nearly all stalk;'—and when the leaf is well grown, it is pronounced 'over large, with a thick coarse stalk,'—'unpleasant or musty in flavour,'—'worm-eaten,'—'not properly cured,'—'packed in a damp state,'—and that, as articles of commerce, they are 'not marketable,'—or 'of no value;'—and of the best it was said, that some tobacco from Holland of much better quality, had been sold under 2*d.* per pound.

"These facts are sufficiently discouraging, and were it not for the author's confidence, that they are the necessary result of inattention to principles, it might perhaps be considered more prudent to withhold them when recommending a new culture. But as others might commit the same mistakes, it is proper at once to meet the difficulty, that we may at the same time suggest a remedy. Besides, the tobacco of Arracan and that from Bombay has shown that even without the aid of foreign seed, some of very superior quality may be grown in India; while the following facts prove that by careful management, Virginia seed may be made to yield a good crop, even in the rich soil and climate of Bengal. This tobacco was imported in the Sir T. Munro, and produced from Virginia seed sown in the garden of the Agricultural Society of Calcutta: 'the method pursued in its cultivation and preservation is that generally adopted by the Americans.' This specimen was submitted by the Court of Directors to the examination of some dealers and manufacturers in London, who pronounced it to be 'the best sample of Indian tobacco they had ever seen. In flavour and general appearance of the leaf, it approaches the descriptions which are usually selected here for manufacturing into cigars, and for smoking in a pipe, namely, Havannah, St. Domingo, and Ameersfoorth (Dutch): all of which command high prices in relation to other kinds of leaf tobacco. A portion of this sample has been made into cigars here, which are

much approved; and it is probable that if a moderate supply of tobacco of the like quality were in this market, it might be in some request for making into cigars, and would come into competition with the tobacco of St. Domingo, which is at present worth from 6*d.* to 8*d.* per pound in bond.'

"The successful result of this experiment will, it is hoped, remove any unfavourable impression produced by the former, and prove, as might be inferred indeed, from the Arracan and Bombay samples, that there is nothing in the climate of India unfavourable to the production of good tobacco, when this is attempted with careful treatment in a good climate. The more temperate climate of North America, and the modified one of tropical situations, is attained in India by the cultivation being commenced in the cold weather, and the spring temperature equalling the summer one of more northern climates is sufficient to bring it to perfection. That it may also be grown of a superior quality in more southern provinces, is very probable, for it is not a puny seedling which is to be nursed into healthful existence, but the gross-feeding weed luxuriating in rankness, which is to be reduced to more moderate dimensions, and starved into fineness—objects easily affected by a less rich nourishment, and a drier and more open atmosphere, both attainable in poorer, though good soils, or the more elevated parts of the peninsula, and in many parts of India, as along the banks of the Ganges, as well as in Tirhoot, Rohilcund, and the Doab; and across India, in Bundelcund, Malwa, and the northern provinces of the Bombay presidency. Success will still depend upon the skill of the agriculturist, in suiting the richness of his soil to the dryness of his climate, diminishing the former in proportion to the moisture of the latter, though it is doubtful whether as fine tobacco can be grown in a moist as in a dry climate. It must be remembered, that the present excellence of American tobacco is not the spontaneous effusion of the soil, but the result of the unwearied attention of both the Government and cultivators to the improvement of its produce; for some of the American planters seemed to think in former times, as Indian Zumeendars appear to do at the present day, that '*any thing was good enough for the merchants.*' (Tatham, p. 141). The Government, jealous of the good name of Virginian produce, issued rules for checking over-luxuriance, and appointed officers to see them enforced, as well as for rooting up inferior plants: while every hogshead of prepared tobacco was taken to Government warehouses, to be inspected by competent officers before it could be exported; and all of an inferior quality condemned to be burnt (Tatham, p. 69—106; and 138, 207).

"It is unnecessary to dilate on the cultivation and cure, as these are detailed in the instructions sent out to India by the Court of Directors

in 1819, and may be seen fully described in works easily procurable; as *Loudon's Encyclopædia of Agriculture,* which gives, in an excellent article, the cultivation in a variety of places; and '*The Tropical Agriculturist,*' which includes the most valuable portions of 'Tatham's Essay on Tobacco,' as well as the cultivation of Shiraz tobacco, from the Hort. Trans. v. I. n. s. p. 205; it is hoped that the remarks in this article on the necessity of paying attention to the strangely-neglected subject of climate will not be without their use. It must never be lost sight of, that the Americans pay equal care and attention to the soil, the seedling nursery, the transplanting, earthing up, keeping the ground clear, removing inferior leaves and side shoots, topping so as to leave only eight to ten leaves on each plant, airing, fermenting, drying, prizing, and packing. It is to be wished, as recommended in the case of Cotton, p. 89, that the effects of good culture and careful curing should be tried upon seed produced from Bhilsa, Arracan, &c. as well as upon that of foreign growth, but at first in situations as similar as possible to them, in climate, soil, and production. This, however, can be hoped for to any extent only, when more attention is paid to the inferences to be deduced from a comparison of scientific data; for the empirical attempts of purely practical people, though sometimes attended with success, are as frequently followed by failure. It is to be hoped that my friend Mr. James Prinsep, will persevere in getting good accounts of the climate of every part of India; and it is to be wished that good specimens of colonial produce could be sent to the several parts of India, so that cultivators might get an idea of what they had to rival, as well as of the prices which would reward their successful exertions.*" Page 280 to 289.

" The *Convolvulaceæ,* are well known for the purgative properties of the roots of many of the family, as of Jalap, Scammony, &c. *Convolvulus panduratus* is substituted in the United States for the former; so, in India, *Ipomœa Turpethum, toorbud* of the Arabs, supposed to be a corruption of the Sanscrit *trivrit,* Hindee *nusot,* is accounted a powerful cathartic, and by Dr. Wallich an excellent substitute for Jalap, (v. Gordon, in Roxb. Fl. Ind. ed. Wall. 2. p. 58); so the seeds of *Ipomœa cærulea, hub-ool-nil, kala dana,* are accounted purgative in India, as are several others of this family. The annual shoots not having secreted the due proportion of resin, are inert, and even edible; as the stalks of *C. edulis* and *repens.* The tubers of *Batatas edulis,* or sweet potato, have long been employed as food.

* " Having sent the foregoing remarks to Mr. W. Johnson for perusal, he has been good enough to send me the gratifying intelligence, while the previous sheet is passing through the press, as a 'strong corroboration of my views respecting the capabilities of the country,' that tobacco has actually arrived from India, and been sold in the London market for 8*d.* a pound!"

" *Convolvulus Scammonia,* of which the dried resinous juice forms scammony, *sukmoonya* of the Arabs, is chiefly produced near Smyrna and Aleppo; but only inferior kinds find their way to India, though there is little doubt that it might be produced of the best quality in Northern India. The Jalap exported from Vera Cruz was supposed to be produced in that neighbourhood, or in that of Xalapa, by *Ipomœa macrorhiza* of Michaux. But it was known to Humboldt (New Spain, vol. iii. p. 36), and also to Dr. Coxe (v. Thomson. Elem. of Mat. Med. ii. p. 289), to be the produce of a different plant. The latter calls it *I. Jalapa,* and the former says, ' that the true *Purga de Xalapa* delights only in a temperate climate, or rather an almost cold one, in shaded valleys, and on the slope of mountains.' The true plant has been fully described by Professor Don, in a paper read before the Linnean Society, from specimens grown from seeds sent by Dr. Schiede, which he procured from Chiconquiera, on the eastern declivity of the Mexican Andes, at an elevation of 6,000 feet. Mr. Don retains for this the name *I. Jalapa,* instead of *Schiedeana* and *Purga,* given it by Zuccarini and Wenderoth. The discovery of the true locality is important, as shewing that the Jalap requires a cool climate, and may no doubt therefore be cultivated in the Himalayas." Page. 308.

" The genus *Rheum,* or Rhubarb, so important in commercial point of view, is more interesting than any other in its geographical distribution. *R. Rhaponticum* is found in several parts of Russia, on the shores of the Bosphorus and of the Caspian Sea, eastwards in Siberia, and the lower mountains of the Altai Range: *R. sibericum* and *undulatum* of Pallas are considered by Ledebour to be only varieties of this. *R. leucorhizum (nanum Sievers)* is also found in the Altai mountains and the deserts of the Kirghis. Neither of these afford the rhubarb of commerce, which is not found within the Russian territories, but well known to be brought by the Chinese to the Russian frontier town of Kïakhta, according to the treaty formed between these powers in 1772. The Chinese obtain the rhubarb produced in China Proper, from that part of the province of Shensee, now called Kansu, situated between N. lat. 35° and 40°. But the best, according to the Missionaries, who say it is called *Tai-hoang,* in the province of Setchuen, from the mountains called Sue-chan, or of snow, which extend from N. lat. 26° to 33°, and from about 100° to 105° of E. longitude. That from the latter province probably forms much of what is called China rhubarb: the Missionaries met large quantities of it brought down in the months of October and November. That from Kansu may afford some of what is called Russian rhubarb; but both Pallas and Rehman have ascertained that the greater portion, if not the whole of this, is obtained in April and May, from the clefts of rocks in high and arid moun-

tains surrounding lake Kokonor. Bell also learnt that it was the produce of Mongolia, and Marco Polo, of Succuir, in Tanguth. Dr. Rehman ascertained that the trade is in the hands of one Bucharian family, who farm the manopoly from the Chinese government, and reside at Si-ning, a Chinese town on the very frontiers of Tibet, 3,000 verstes from Kiakhta, and twenty days' journey from *Kian-sin* and *Schan-sin*, Tangutian towns, where the Bucharians go to purchase rhubarb. This would bring the rhubarb country within 95° of E. long. in 35° of N. latitude, that is, into the heart of Tibet. As no naturalist has visited this part, and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this rhubarb. Pallas thinks it may be *R. compactum*, as the leaves are said to be round and toothed; the rhubarb merchants, to whom he showed the plant, did not know *R. palmatum*. Both these were obtained from China and Tartary, as well as *R. tataricum* and *undulatum*. It is probable, therefore, that some of these yield a portion of the rhubarb of commerce, as they have some of very good quality, when cultivated in England and France. But as it is improbable, from the nature of the country that the best rhubarb is confined within very narrow limits, it becomes interesting to ascertatn how near it approaches the British territories in India, in order to share in the trade, or attempt the cultivation.

"That this might very reasonably be undertaken within the British territories, will be apparent from the distribution of rhubarb in the Himalayas. Passing from Hindookhoosh, where is found *Rheum Ribes* (ribas of the Persians), mentioned by Chardin, &c., more recently by Lieut. Burnes, who also met with rhubarb at Caubul and Bokhara; we find rhubarb common in the Himalayas, as on Choor, near Jumnotree, on Jacho in Kemaon, Gossainthan in Nepal, and near Tassisudon in Butan, that is, from 30° to 27°, and from E. long. 79° to 89°, and at elevations of 9,000 and 10,000 feet. Mr. Moorcroft discovered rhubarb at Niti, and next day between Niti and Gotung, that is, at elevations of 12,000 feet. His companion, Major Hearsay, thought he saw three kinds, and has described two of them to me, one round-leaved and long-stalked, and the other short-stalked, but large and broad-leaved (*R. Moorcroftianum*, nob.), with the root more purgative than that of the former. These are called *doelooh* or *dooloo* by the Bhoteas, and *tantara* (Webb), *rantra* (Hearsay). One of these appears to be the rhubarb described by Dr. Meisner under the name *R. Emodi* (*R. Webbianum*, nob.), which differs from the original *R. Emodi*, described by Mr. Don, under the name *R. Australe*. If we turn our attention to the northern face of the Himalaya, which has so many features of a Tatarian climate, we find *R. spiciforme*, nob., discovered by Mr. Inglis on the Kherang Pass, and at several places beyond. Dr. Gerard describes the table-land of Tatary as covered with rhubarb, at elevations of 16,000

feet. Mr. Moorcroft sent some rhubarb, which for compactness of texture, colour, and properties, was as fine as any I have ever seen, from near Ludak, in N. lat. 34°, and E. long. 77½°.

"But these are only the western boundaries of the elevated, cold, and bleak regions, known under the names of Tatary, Mongolia, and Tibet, of which Kunawur is essentially a part, participating in the same great physical features, climate, and vegetation; already possessing one, if not two species of rhubarb, and having the best growing in its immediate vicinity. There can therefore be no rational doubt about the successful cultivation of the true rhubarb in territories within the British influence, as in Kunawur, or the Bhoteah pergunnahs of Kemaon, and that with little more labour than placing the roots or seeds in favourable situations, and this in a country where little else can be produced fit for export. The only difficulty will be to obtain specimens or seeds of the true rhubarb. But it must be considered, that even the eastern boundaries of the country producing the best rhubarb, and which, to make their purchases, the Chinese reach, after a journey of twenty days, is only one half the distance from the British territories in Upper Assam, that it is from the Russian town of Kiakhta. Also, that there is reason for supposing rhubarb may be found much further to the westward, and consequently still nearer to the Himalayas. It would not therefore be difficult from Kunawur, or Upper Assam, or for such active and intelligent officers as Messrs. Traill and Hodgson, in Kemaon and Nepal, to obtain some of the seed or roots. They might at the same time succeed in establishing a trade in rhubarb with Tibet or Western Mongolia, by means of the Tatars who resort to the hill fairs. This trade might easily be encouraged by the government purchasing all the rhubarb it requires, which might thus be employed for hospital use after crossing the frontiers, instead of as now, after making a journey of 20,000 miles, or nearly the circuit of the globe.

"Even this would not probably be so difficult as at first sight appears, for the whole of the Tatarian rhubarb trade is not engrossed by the Russians, as much of it takes a western direction, and has always formed one of the imports from China into Bokhara, whence passing to Smyrna, it is known in Europe as Turkey rhubarb. Chardin, treating of that known in Persia, states—'La meilleure vient du pais des Tartares Orientaux qui sont entre la Mer Caspienne et la Chine' (Voyages, ii. p. 12). Rhubarb, also of the best quality, and closely resembling the Russian, is to be purchased in the bazars of N. India, under the name *rewund-khatai*, from the old name *Cathay*, of Northern China. This is sold for ten times the price of the Himalayan rhubarb, which makes its way into the plains of India through Khalsee, Almora, and Butan, and is probably from its usual dark colour and spongy texture, the pro-

duce of either or both *R. Emodi* and *Webbianum*.* The roots of *R. spiciforme* and *Moorcroftianum* are lighter-coloured and more compact in structure. Rhubarb is, in India, commonly denominated *rewund-cheenee (rivend-tchini* in Persia, *Chardin)*, with *rawund* assigned as its Arabic, and *reon* (*ρηον*) as its Greek name. The above are evidently the *rewund* of Avicenna, and the *raued-seni* of the translators of Mesue. Three kinds are described in Persian works on Materia Medica. 1. *Cheenee*; 2. *Khorassanee*; 3. *Hindee.*

"The roots of rhubarb we have seen to be pretty uniform in secreting the peculiar principle, called *Rhabarbarin*, possessing properties which make them useful as purgative medicines; but these are also accompanied by astringent properties, while the stalks secrete acid, chiefly acetic and tartaric, with oxalate of lime (Fée) oxalic acid (Turner); this is most fully developed in Sorrel *(Rumex Acetosa* and *Acetosella)*, while the astringent principle, dependent on the presence of gallic acid and tannin, in many of the roots of the *Polygoneæ*, is most fully secreted in *Coccoloba uvifera*, and 'so powerful as to rival gum kino in its effects.' (Lindley). Some of the *Polygonums* are, however, acrid, as *P. Hydropiper* and *acre*, and others, as *P. tinctorium, chinense*, and *barbatum*, yield a blue dye-like indigo, in Cochin-china, China, and Japan. The albumen of *Polygoneæ* being farinaceous, and in some considerably developed, has been used for food, as buckwheat, *Fagopyrum esculentum*, and *tataricum*, cultivated in many parts of Europe, and in the Himalayas with *P. emarginatum*. The two first are no doubt originally inhabitants of the mountains of Central Asia, and were first known in Europe under the name of 'frumentum Sarracenicum.' Both are much cultivated in Russia and Siberia; the first is usually preferred in other parts of Europe, but the second grows in every soil, and requires less time; Professor De Candolle says it is preferred to *F. esculentum* in Piedmont in the Luzerne valley, because it ripens quicker, and therefore in late years, and at higher elevations in the Alps. In the Himalayas, *Fagopyrum esculentum* (*phaphra* and *kooltoo* of the natives) is also most commonly cultivated, but *F. emar-*

* "That the rhubarb of this species is not without some valuable properties, we may learn from Dr. Twining's report on experiments made on forty-three cases in the general hospital of Calcutta, of which the following are extracts:—Dr. T. states, that it has 'less aroma and more astringency to the taste than the best Turkey rhubarb; in doses of 2 or 3 drs. it has a good purgative effect, operating three or four times, nearly as freely as the best Turkey rhubarb. The effects of small doses of the remedy, as a tonic and astringent, are highly satisfactory, as far as four or five cases can be relied on. In this respect its efficacy appears to be superior to corresponding quantities of the best rhubarb. On the whole, it appears not an eligible remedy in obstinate costiveness, on account of its aroma and astringency; 'it is not apt to gripe,' 'but it is very efficacious in moderate doses for such cases as rhubarb is generally used to purge; and its cultivation at the Mussooree garden may be expected to afford a very valuable remedy, which is less disagreeable to take than the best Turkey rhubarb, nearly equally efficacious as a purge, and very superior in small doses as a tonic and astringent in profluvia."—*Trans. Med. and Physic. Soc. of Calcutta*, vol. iii. p. 441.

ginatum (*ogla*) which comes very near the Linnean specimens of *F. tataricum,* is preferred in higher and drier climates, as in Kunawur. Thus the more closely we examine the distribution of plants and the agriculture of different countries, the nearer do we observe the correspondence in practical results among those which participate in the same peculiarities of climate; and we cannot but admire the bounty of Nature which affords even in what appear sterile wastes, some article fitted for the food of man, and suited to the climate, with others which are adapted for commerce, as buckwheat, borax, musk, and rhubarb, from the three kingdoms of Nature, in the cold, bleak, and arid plains and mountains of Tatary." Page 314 to 317.

"The herbaceous parts of many of this family, (*Chenopodiæ*) as spinage, &c. being insipid and mucilaginous, have been used as vegetable food in many parts of the world; so, in India, are several species of *Chenopodium* (bhutwa, &c.) *Beta bengalensis* (palung and paluk), *Spinacia tetranda* (isfanakh), and also *Basella rubra* (poee). The roots of beet and mangel-wurzul also afford food : the successful extraction of sugar from the former, is one of the triumphs of science. The seed of some are considered aromatic and stimulant, as *Chenopodium Botrys,* and *Ambrosoides. C. vulvaria* is said by M. Chevalier to exhale ammonia during the whole of its existence (Lindley, Nat. Ord. p. 168). The loose cellular texture of many of this family is supposed to favour the absorption and deposition of soda in their substance, when growing in the vicinity of the sea; and this in such considerable quantities, as to afford, by the incineration of several species of *Salsola, Salicornia, Sueda,* &c., the chief supply of the barilla of commerce on the coasts of Spain, the S. of France, and of Arabia. Dr. Roxburgh has already suggested (Flor. Ind. 2. p. 62), that *Salicornia indica* and *brachiata,* with *Salsola nudiflora,* are so abundant on the coasts of India, as to be able to supply barilla sufficient to make soap and glass for the whole world. A coarse kind of barilla is procurable in Indian bazars, under the name *sejjee muttee* (soda-earth.) This is procured by the incineration of plants (unknown) growing not in the neighbourhood of the sea, but on the shores of the salt lakes scattered through the Indian deserts. It seems worthy of inquiry, whether the *Salsola,* so abundant on the banks of the Jumna, would yield soda, and also, whether it would be possible to grow any of these soda-secreting plants in the saline and barren country to its westward, where nothing else will now grow." Page 319.

"The *Myristiceæ,* usually placed near *Laurineæ,* are considered by Dr. Lindley more closely allied to *Anonaceæ.* They are natives exclusively of the tropics of India and America. In the Old World, they

extend southwards from the tropical islands to New Holland, and northwards along the Malayan peninsula to Silhet, where is found *M. longifolia*, Wall., and in the mountains of that district *M. floribunda*, Wall., with *M. angustifolia*, Roxb. Other species are peculiar to the peninsula.

"*Nutmeg* forming the albumen, and *Mace* the arillus of the seed of *Myristica moschata*, are well known for their grateful and aromatic properties. They are produced in the largest quantities in the Moluccas, but have been successfully cultivated in Penang and Bencoolen, but especially in Sumatra. The trees thrive and bear fruit even so far north as the Calcutta Botanic Garden, and might no doubt be successfully cultivated in Travancore and the Tinnivelly district, as well as on the Malayan peninsula. The nutmeg is called *juephul* in India, with *jouz-boa* (fragrant nut) as its Persian name ; and mace—*jawuntree, P. bisbaseh* with *amakun* (*μάκερ*) assigned as its Greek name. Other species yield aromatic nuts, as *M. tomentosa*, perhaps the *M. dactyloides* of Gærtner ; *M. officinalis*, according to Dr. Martius, in Brazil, and *M. Oloba*, in Santa Fé. The plants of this family, like those of the following, have a volatile, as well as a fixed oil, contained in their nuts. The latter is so abundant in *Virola sebifera*, as to be extracted for economical purposes. Like many of the *Laurineæ*, the *Myristiceæ* exude an acrid reddish-coloured juice from incisions in their bark." Page 323 to 324.

"The properties of Indian *Euphorbiaceæ* correspond with those which have been observed in plants of this family in other parts of the world. All abound in a milky juice, which contains *Caoutchouc*, and is generally united with a highly acrid principle of a very volatile nature, and therefore easily dissipated by heat. According to the degree of concentration of this principle is the innocuous or deadly nature of the substance with which it is combined. Thus the seeds of some *Euphorbiaceæ*, in which it exists in small quantity, are eaten ; as those of *Aleurites ambinux*, and of *A. triloba*, in India : the fruit of *Cicca disticha* is acid, as is that of *Emblica officinalis*, forming *Emblic myrobolans*. Though united with fecula in the roots of *Janipha Manihot* or the Cassava, so that they are poisonous when raw, it is so effectually separated by heat, as to afford an abundant and nourishing food to thousands in S. America, the West-Indies, and Mexico. The plant succeeds completely in India, but it is remarkable that it should have been made so little use of, though Sir W. Ainslie has mentioned making *Tapioca* from it when in India. This acrid and stimulant principle is combined with fixed oils in many of the seeds of *Euphorbiaceæ*, which are well known for their uses as purgative medicines, as the

castor oil plant, *Ricinus communis*, *khiroa* or *cherua* of the Arabs, *aranda* of the Hindoos, and *κρότων* and *κίκι* of the Greeks; and also several species of *Jatropha*, as *J. Curcas*, physic-nut (*H. bagh-burinda*). *J. glandulifera* is used as an escharotic to remove opacities of the eye in India (Roxb.). The most active, being at the same time safe and which is perhaps the most extensively used in India, and also considered emmenagogue, is the *Croton Tiglium*, Grana Molluccana and Tilli of old Pharmacopœias, *jumalgotta* of the Hindoos, *dund* of the Arabs and Avicenna, for which, in N. India, those of *C. polyandrum* are substituted, and called by the same name. Species of *Phyllanthus* are considered diuretic, others of the order sudorific, and some emetic. The best substitutes for Ipecacuanha are said to be some species of *Euphorbia*, as *E. Ipecacuanha*, *Gerardiana*, &c.; also *Pedilanthus tithymaloides*. Space would fail, if we were merely to enumerate all those to which useful properties have been ascribed, but they may be seen in the Essay of M. Adrien de Jussieu, Lindley, Fée, Roxburgh, and Ainslie. The acrid and stimulant principle is united with essential and fragrant oil in some barks and woods, as in *Croton Cascarilla*, *Eluteria*, and *gratissimum*. The wood-cutters of the Delta of the Ganges state, that no *Agallochum* is afforded by *Excœcaria Agallocha* (Roxb.). A peculiar principle (*cereo-resine*, Fée), called *Euphorbium*, *furfiyoon*, (Gr. *afirbiyoon*) of the Persian works on Materia Medica, and said in them to be a produce of Soudan and Africa, is considered by botanists to be yielded by *Euphorbia officinarum*, *Canariensis*, and *antiquorum*. I doubt whether the last, at least the species so called in India, yields any, as in some experiments I made on the subject, I found the juice comparatively inert. The leaves of *E. nereifolia* are considered purgative and deostruent (Ainslie); the root of *E. ligularia* mixed with black pepper, is employed for the cure of snake-bites. Some of this family are violent poisons, as *Hippomane Mancinella*, *Hura crepitans*, *Hyænanche globosa*, *Excœcaria Agallocha*, *Sapium aucuparium* and *indicum*. Seeds of the latter intoxicate fish, as does the bark of *Fluggea virosa* (Roxb.), and the hairs of some species, as *Tragia cannabina* and *involucrata*, sting as violently as nettles. Some species yield oil useful for burning, as *Elæococca* (*Dryandra*, Thunb.), *verrucosa*, and *Vernicia*, the oil and varnish trees of China, *Aleurites triloba*, *Ricinus communis*, &c.; while *Stillingia sebifera*, or tallow-tree of China, yielding a vegetable fat, is now common about Calcutta, but it is only during cold weather that this substance becomes firm (Roxb.). The most useful product of the family, however, and that which has lately become so important an article of commerce, and of great utility in a variety of arts, is *Caoutchouc*, so well known as *India-rubber*, and exported principally from Para. This is chiefly yielded by *Siphonia elastica* (*Hevea guianensis*, Aubl.), a tree of Guiana and Brazil, which

would no doubt thrive in Bengal. *Caoutchouc* is also imported from Penang, the produce of *Urceola elastica* (As. Res. v. p. 157 and 167), but I hope it will be also from the continent of India.

" The expressed oil of the seeds of *Jatropha Curcas*, boiled with oxide of iron, is said to form the varnish used by the Chinese for covering boxes (Lindley). The juice of this plant is of a very tenacious nature, and when blown into, forms very large bubbles, probably owing to the presence of *Caoutchouc ;* this is also afforded by an African tree of this order.

" The dye called *Turnsol*, is yielded by *Crozophora* (*Croton*) *tinctoria*, as is a colouring matter by *C. plicata* (v. Roxb. Fl. Ind. iii. p. 68) ; also by *Rottlera tinctoria*, of which the strigose pubescence, like that of *Mucuna pruriens*, is administered for expelling intestinal worms. Several of this family yield hard and valuable timber in India, as *Emblica officinalis*, *Rottlera tetracocca*, *Adelia castanicarpa*, species of *Briedelia*, *Cluytia*, &c. African oak or teak is supposed by some to belong to this family.

" Though belonging to so dangerous a family, the leaves of *Plukenetia corniculata* are said to be eaten as a vegetable ; and the domesticated Arindy silk-worm (*Phalæna Cynthia*,) is fed upon the leaves of *Ricinus communis*. (Roxb.)" page 327 to 329.

" The tribe of Peppers is well characterized by the warm, pungent, and aromatic properties for which some of the species have been celebrated from the earliest to the present times, either as condiments, or for their uses as stimulant and stomachic medicines. Of these, *Piper nigrum*, affording the black and white pepper (Pers. *pilpil*) of commerce, is, no doubt, the most celebrated. That of Malabar has long been considered the best ; but that of Sumatra, and many of the islands, is reckoned nearly as good. Mr. Crawford states, ' the pepper countries extend from above the longitude of 96° to that of 115° E., beyond which no pepper is to be found, and they reach from 5° S. lat. to 12° N., where it again ceases. Within these limits, we have Sumatra, Borneo, the Malayan Peninsula, and certain countries lying on the east coast of the Gulph of Siam.' It is cultivated all along the Malabar coast, and also near Courtallum. Dr. Roxburgh describes it as being found wild in the hills of the Rajahmundry district. But this may be the species which he describes under the name *P. trioicum*, of which I have seen no specimens ; but the pepper Dr. R. states to be ' exceedingly pungent, and by merchants at Madras reckoned equal, if not superior to the best pepper of the Malabar coast or Ceylon.'

" The betle-leaf, *P. Betle*, *pan* of the natives, Sans. *Tamboolee*, Pers. *tumbol*, so well known for its moderately pungent and aromatic properties, is cultivated throughout tropical Asia, and over a great part of

India. I have seen it as high as Bundlecund and the southern parts of the Doab, though it requires a rich moist soil, and shady situation. These are obtained in Northern India by irrigation, and covering the plants around and above with a light thatch of grass or reeds. *P. longum*, *pippul* of the natives, and the root *pippula-moola* and *peeplamoor*, is cultivated in Bengal and the Circars, both for its pepper and its roots: the former in use as a condiment, and the latter extensively so as a stimulant medicine. *P. chaba* (As. Res. ix. 391) is called *mugpeepul*, and similarly used. The root of *P. methysticum* is that employed in the Society and Friendly Islands, under the name of *Ava* or *Kava*, to produce by fermentation a pungent and stimulant beverage. *P. inebrians* is substituted for it. *P. anisatum*, as its name implies, smells of Anise; other species possess the general pungent and stimulant properties of the family. *P. Cubeba*, grown in Java and Penang, affords the well known *Cubebs*, which are the *kubabeh* of the Arabs, *kubab-cheenee* of the Hindoos; for these *kurfiyoon* is assigned as the Greek name, intended probably for *Carpesium*, as this has been supposed by some authors to be cubebs. The seeds of *tezbul*, *Xanthoxylum hostile*, p. 157, are said to be one kind of cubebs. They have much the same warm, pungent, and stimulant properties." Page 332 to 333.

" The HEMP (*Cannabis sativa*), so well known in Asia from affording an intoxicating drug, and in Europe the strongest fibre for rope-making, is cultivated for the former product in small quantities everywhere in the plains of India, near villages: but in the Himalayas it is extremely abundant, at elevations of 6,000 and 7,000 feet, and of very luxuriant growth, rising sometimes to a height of ten and twelve feet. Here, though it likewise affords an intoxicating drug, it is also known for the tenacity of its fibre, which is employed by the mountaineers in Gurhwal and Sirmore for making a coarse sackcloth, and strong ropes for crossing their rivers. Considering that this fact was early made known by Col. Kirkpatrick in his account of Nepal, ascertained by Gen. Hardwicke in his journey to Srinuggur, and repeated by Dr. Roxburgh in his account of experiments on substitutes for hemp; it is remarkable that no one should yet have attempted to obtain it for commercial purposes, particularly as during the late war so many attempts were made to find an efficient substitute for this important plant; and so many others are cultivated in India for the product which this yields of so superior a quality. It may be mentioned, that I have seen it abundant in the Deyra Doon and plains of Northern India, especially in the upper part of the Doab Canal; of these only a small portion is employed for making *bhang;* but this might probably be obtained from the leaves, even while the stems yielded the fibre.

" The hemp is supposed by some to be a native of India; it no doubt

is so of some part of Asia. It appears to be wild in the Himalayas. The Arabic name *kinnub* is thought to have been corrupted into the Dutch *hennep,* whence we no doubt have our *hemp ; kinnabis* is given as its Greek name by the eastern writers on Materia Medica ; *bunj* as Persian ; and *bhung* and *bhang* as Hindee. It is said by Herodotus to have been made into cloth by the Thracians, and is now well known to be extensively cultivated in Italy, Poland, and Russia to the south of Moscow, with a small quantity only in England. It requires a rich soil and moist situation ; is pulled when in flower, if the fibre alone be required, but if the seed also, then the male plants are pulled as soon as they have shed their pollen, and the others when the seed is ripe. These yield oil, which is employed by painters, or they are used for feeding poultry ; so that every part of the plant is turned to some account. The leaves are sometimes smoked in India, and occasionally added to tobacco, but are chiefly employed for making *bhang,* and *subzee,* of which the intoxicating powers are so well known. But a peculiar substance is yielded by the plants in the hills, in the form of a glandular secretion, which is collected by the natives pressing the upper part of the growing plant between the palms of their hands, and then scraping off the secretion which adheres. This is well known in India by the name *cherris* and is considered more intoxicating than any other preparation of this plant, which is so highly esteemed by many Asiatics, serving them both for wine and opium ; it has in consequence a variety of names applied to it in Arabic, some of which were translated to me, as ' grass of fuqueers,'—' leaf of delusion,'—' increaser of pleasure,'—' exciter of desire,'—' cementer of friendship,' &c. Linneus was well acquainted with its ' vis narcotica, phantastica, dementens.' It is as likely as any other to have been the *Nepenthes* of Homer. Besides *kinnabis,* it has *defroonus* assigned as a Greek name.

" It is interesting to find in the same family with the hemp, the *Urtica tenacissima* or *Calooee* of Marsden, *Rami* of the Malays, a native of Sumatra, also of Rungpore, where it is called *kunkomis,* and which Dr. Roxburgh found one of the strongest of all the vegetable fibres, which he subjected to experiment. Average weight with which lines made of the different substances broke, were, *Asclepias tenacissima, Jetee* of the Rajmahl mountaineers, 248 ; *Urtica tenacissima, Calooee,,* 240; the strongest *Sunn, Crotolaria juncea,* 160. Hemp, *Cannabis sativa,* grown in the year 1800, in the Company's Hemp Farm near Calcutta, 158, but much stronger when tanned. Europe hemp, however, was always found stronger than Sunn, though not more so than the others. Dr. Roxburgh speaks of the beauty, fineness, and softness of the fibre of this plant, and says, he learnt from a friend resident at Canton, that the grass-cloth of China is made of this material. It is cultivated in Sumatra for the fibres of its bark. The Malays use it for

sewing-thread and twine, and for making fishing-nets. It is as readily cultivated as the willow from cuttings, grows luxuriantly in the northern, as in the southern parts of India, throws up numerous shoots, as soon as they are cut down, which may be done about five times a-year. Dr. Roxburgh, however, found some difficulty in cleaning the fibres of this plant, notwithstanding his anxious desire to succeed with this substitute for both hemp and flax. *Urtica heterophylla*, is another Indian nettle, which succeeds well in every part, and of which the bark abounds in fine white, glossy, silk-like strong fibres (Roxb.). The stinging properties of the nettle are well known, but they are all exceeded by the last mentioned plant, as well as by *U. crenulata* and *stimulans*.

"The Hop (*Humulus Lupulus*) is another plant of this family, which affords fibre fit for rope and cloth-making, and which would be a valuable acquisition to India, as many situations at moderate elevations are admirably fitted for the brewing of beer. In one establishment which I visited several times, the temperature within the buildings never varied much from 60°. The hop is also a remarkable instance of the change of prejudice with regard to the same thing. Thus, at an early period, in the petition against it, we hear of it as the 'wicked weed called hops;' in a subsequent age we find it noted as a subject of admiration, that 'on Kent's rich plains green hop-grounds scent the gales;' and now, many think, that no beer can be made without it. The plant grows wild in most parts of Europe, and is described further south by Bieberstein, in his Flora Tauro-Caucasica, as 'copiosa in dumetis et sepibus.' It requires a rich strong soil, especially if it be rocky a few feet below the surface. It is planted in October or March, shoots up about the middle of April, flowers in July, and ripens its seeds in September. Warm seasons, without wet, are required for good crops; great heat after rains, and high winds, are destructive. It might be cultivated in Nepal, or, perhaps, the Deyra Doon; but it is feared that the rainy season would interfere much with the proper growth of the plant. The subject is well worthy of experiment, and a few plants would suffice to ascertain the effects of the seasons." Page 333 to 335.

XVII.—Miscellanea.

A circular letter from the *Royal Society of London* has been sent to the *Asiatic Society of Bengal*, as we learn from the Proceedings of that body. We subjoin a copy for the information of the scientific readers of this Journal, and shall be glad to see the time arrive when the *Madras Society* shall have attained a celebrity entitling it to the consideration of a similar notification from the *Royal Society*.

Royal Society of London, Somerset House, Nov. 19, 1835.

Sir,

I am directed by His Royal Highness the President and Council, to acquaint you, for the information of the *Asiatic Society of Bengal,* that His Majesty the King has been pleased to grant two Gold Medals, of the value of Fifty Guineas each, to be awarded by the Royal Society on the day of their Anniversary Meeting in each succeeding year, for the most important discoveries in any one principal branch of Physical and Mathematical knowledge.

His Majesty having graciously expressed a wish that scientific men of all nations should be invited to afford the aid of their talents and researches, I am accordingly directed by the Council to announce to you, Sir, that the Royal Medals for 1838, will be awarded in that year, the one to the author of the most important unpublished paper in *Chemistry,* which may have been communicated to the Royal Society for insertion in their Transactions, after the present date and prior to the month of June in the year 1838;—the other, to the author of the most important unpublished paper in *Physics,* which may have been communicated to the Royal Society for insertion in their Transactions, after the present date and prior to the month of June in the year 1838.

I have the honor to be,

Sir,

Your very obedient humble servant,

Charles Konig, *For. Sec. R. S.*

The subjoined letter has been received, and the Editor lost no time in putting the work referred to, in the hands of a competent judge, whose analysis of the work, necessarily brief, as short time was permitted for the task, will be found under the head of *Notices of Books.* We hope that sufficient has thus been done to point out to orientalists of the South of India, the value and importance of Mr. Turnour's researches, and that scholars will give him the aid and advice he requires at their hands.

Kandy, *July* 8, 1836.

Sir,

I have to beg the favour of your presenting the accompanying pamphlet to the *Literary Society of Madras.* It is intended, as explained in the Introduction, to serve as a prospectus to an historical work, in the publication of which I am now engaged.

Convinced of the utter hopelessness of success in attracting attention to a publication connected with oriental literature, which in other hands has already disappointed public expectation, I have adopted the present preparatory course, with the view of eliciting the criticism of oriental societies and scholars on this particular work, before it issues

from the press, and of thereby at once obtaining either a confirmation or refutation of the expectations I entertain as to its pointing out the road to a new and interesting field of research in Asia.

In the proceedings of the *Asiatic Society* published in the Journal of July last, an invitation will be found on my part to the Members of that Institution, to enter upon that criticism, whenever the work might be submitted to them. I have no doubt, from the manner in which the request was then received, of its being complied with. It would be satisfactory to me, if oriental scholars in the *Madras Literary Society*, also offered an opinion on the portion of the original *Páli* work contained in the pamphlet, and the general inferences deduced therefrom in the introduction, as much for the guidance of those who are incapable of consulting the text, as to enable me to decide on the propriety of proceeding in my present undertaking.

I have the honor to be,
Sir,
Your very obedient servant,
George Turnour.

To the Secretary
to the Literary Society
of Madras.

The Reverend Bernhard Schmid informs us that he is occupied in preparing for the press a Vocabulary of the language of that singular people the *Aborigines* of the Neilgherry Hills, to which he invites subscription. The well-known talents and erudition of this gentleman, give assurance of a skilful execution of the project, and we hope a full subscription list will give encouragement to the undertaking, which will, probably, fall to the ground if not supported.

Dr. Wight writes to us from the Pulney mountains, dated 15th September, 1836, as follows:—" I have added two excellent plants to my collection, being such as we had reason to expect before, but never found. I mean a *Magnolia,* the species still undetermined, and a *Circœa.* I wonder if they exist on the Neilgherries and have been overlooked"*. Our enterprizing correspondent further writes— " I was yesterday on a very high peak, I fancy the highest of the hills, which I make, from a single observation, about 7,618 feet above Madras. That observation was perhaps not a very good one, as the weather was awfully bad, myself and all the people with me being nearly drowned with the heavy rain. The barometer stood at 23 inches, the thermometer 18°. cent. I allowed time for the mercury to cool so as to save the complexity of the double calculation for the detached thermometer."

* Perhaps Mr. Schmid, or some other botanical correspondent on the Hills, will inform us.—Editor.

With reference to Dr. Wight's paper at page 300 he writes subsequently,—" A day or two ago I got some interesting notes from Col. Walker on the gamboge plant, and I am by and by to get specimens. I hope ere long to have a sufficiently perfect set to enable me to review the Indian portion of the order."

Mr. Griffith writes us from Suddiya on the Burrampooter :—" In November I either start for Ava, and shall in that case be the first European who has performed the whole journey, or I shall go into Bootan to the grand Llama, or accompany our Commissioner in a tour through Cooch Puhar. Of the three I should prefer the Bootan expedition, as it will take me to an elevation of 8 or 10,000 feet. The trip from November to May, in whichever direction it is taken, will supply me with abundant additional materials. I am determined at any rate to visit the Himalayas. There is no knowing how many new mosses, &c. I would get in six months. I obtained a hundred new ones in six weeks on the Khasiya Hills."

The progress of this enterprizing Botanist through these unexplored regions, is watched with great interest by those attached to the science, and most interesting will be the result to Botany.

Dr. Benza will, we hope, soon be able to inform us of the hitherto unknown geognostic position and relations of the Corundum in southern India, the knowledge of which is a desideratum in geological science. Dr. Benza writes us from Mottipollium, 28th September 1836,—" I am going to examine the Corundum locality, and after having visited Permutty (in Mysore) where that mineral is found, we intend to descend the Cauvery, in boats, to Trichinopoly."

A correspondent, Member of the Madras Literary Sosiety, has sent us a letter from Mr. Hodgson, British Resident at the Court of Nepal, who is engaged on a work on the Natural History of that country, the objects and nature of which we cannot better describe than in the graphic language of the writer himself.

" I have been a collector and observer since 1822, bent upon accumulating *continuously*, so as to procure materials for something like an adequate portraiture, both of the *standard* aspect, and of the *manners* and structure, of species. Neither the one nor the other can be hit by the flying observer, how skilful soever he may be—and we have had heretofore only flying observers. To enable me to make the best use of my materials, I propose to procure the aid of some able men at home, and to describe in co-operation with them, where needful. My drawings are nearly complete; and my notes advancing fast to completion. The former consist of about 100 mammals and their similars, and of

about 500 birds and theirs. They are the work of native artists ; but artists most carefully trained by myself to the observation and faithful delineation of all significant particulars: and each drawing has been compared with, and corrected by, *several fresh* specimens. As works of art, the drawings are very good indeed : and, as subservient to the illustration of natural history, they are inimitably correct and exact. My notes are a running comment on the several species of each bird and beast; catching, with opportunity, such traits of structure or habits as the successive occasions of examination offered to me.

"I am not a professed naturalist, far from it: but every intelligent man, who uses his eyes and ears in India, may learn more of its Natural History, than all books can tell him. And, as I have said, I propose to procure professional aid of the first kind in regard to those branches of the subject which call for it. My wish is to marry my opportunities to competent European skill; and I anticipate from the union something more than such a *Hortus Siccus* as Shaw, Latham, &c. &c. have presented to the public, as the History of *animate* Nature.

"I cannot yet say what the book will cost, because neither the style nor the extent of illustration has yet been fixed; and I could wish to refer the former to the fancy of my subscribers. Shall I publish the drawings separate and in elephant folio, after the manner of Gould's Century: or conjunct with the text and in quarto, after the manner of Richardson's American Fauna? Let my subscribers say; and let them all know that the putting their names *now* on the subscription list, shall in no respect bind them to the contract, provided they disapprove the cost of the work after that cost has been declared. It cannot now be declared ; but a subscription list is wanted to encourage the booksellers to undertake; and the larger the subscription, the cheaper the book ! The work to me is, and has been, a pure labour of love, upon which I have necessarily spent, and still must, a deal of money. I am willing, too, to assist the publisher with a donation of 3,000 Rupees. But that will be a drop in the ocean, and subscription is indispensable."

We submit the following on the subject of the Mackenzie MSS.

TO THE EDITOR OF THE MADRAS JOURNAL OF LITERATURE AND SCIENCE.

SIR,

Perceiving that in a note at p. 173 of your valuable Journal for July last, you have referred to a subject which formed part of a brief conversation with you, that is, the Mackenzie Manuscripts, belonging to the *Asiatic Department of the Madras Literary Society*, I am apprehensive that I might be committing you in the judgment of your readers, if I maintained an entire silence on the subject. For the present there-

fore, in place of any thing better, I transmit the following brief remarks; conscious that they are much beneath the importance of the subject.

As stated elsewhere my attention was first directed to these Manuscripts by Sir Ralph Palmer, then President of the *Madras Literary Society:* he promised me an introduction to them; but as he did not of himself recur to the subject, and as my attention was much engaged on equally valuable manuscripts of my own, I forebore to reiterate the mention of it. Another gentleman, an oriental scholar, whose name I have no permission to make free with, more definitely brought the matter to my notice; and finding the need of some aid in the more modern portion of my enquiries, I succeeded, by the kind and readily conceded favor of A. D. Campbell, Esq. and J. C. Morris, Esq. in getting full access to those MSS. with permission to read and transcribe them. I went to the library of the *Literary Society*, and extended a cursory inspection to the whole of them; setting aside for more careful reading about one-third of the documents on paper, and about one-fifth of those written on palm-leaves. Those selected by me I considered as primary in importance, others as *secondary* to *me;* though not all of them such in themselves. A few of the last may be considered worthless; others of them as meriting attention. In selecting the first kind I chose those in some degree familiar to me, through the medium of Professor Wilson's catalogue; those not so familiar, but bearing on points which I wished to investigate; and those generally which, being in Tamil and Telugu, were within my scope of easier investigation. I may remark, by the way, that it was a subject of regret to find many of the books of paper-manuscripts (as distinguished from those on palm-leaves) greatly injured by *termites* and other insects; extending in a few cases to the destruction, or illegibility, of the documents: attributable I believe to neglect at Calcutta subsequent to Colonel Mackenzie's death, and before they were delivered over to Professor Wilson. Another remark, equally on the surface, is, that the paper and ink were neither of them, for the most part, such as was to be desired; being chiefly country-paper, and very pale ink, become partially, or in some few cases wholly, illegible by time. It was further observed that native assistants had carelessly pasted labels on the books, designating the language, in a great number of cases, quite erroneously, Tamil being termed Telugu and *vice versa.* These errors were afterwards found to be catalogued by Professor Wilson; it being apparent that his assistants at Calcutta had classed the books, as to language, according to the labels, and then simply copied out the table of contents prefixed, which tables are not always accurate. Some of the manuscripts, moreover, were found to be written by the Colonel's native servants in such a scrawl, and with so evident a desire

to fill much room with little matter, as would have merited from a discriminating eye any thing rather than approval and reward. It is much to be regretted that the Colonel did not, or could not, secure the assistance of some person, not being a native, who could have read over, or have had read over to him, the various documents as brought in by native agents, reporting imposition, and (under reference to the Colonel himself) rejecting the worthless, and marking the valuable at once for *careful copying* (at the least) on good record paper, with durable ink; putting the whole into uniform and respectable binding. In such a case the assorted matter would have been so much the more valuable, and the whole might have longer defied the tooth of time. As the case is, however, the only resource is to make the best of what is in good preservation; and the doing so ought not to be very long delayed.

In afterwards going through the palm-leaf manuscripts, some things more serious were discovered. It appeared that in the various operations of untying and tying up again, to which they had been subject, and specially (I believe) during an examination at the College itself, the different leaves had become intermixed, changed to different books; and, in some cases, abstracted or lost. For example I was peculiarly disappointed when on untying a book with a promising title on the label, expecting it to clear up some obscurities in a great change of dynasty at Vizianagarum, the book, which promised to be a history of the life and actions of *Narasinga-rayer*, was found to be composed of some fragments only of that work; and, for the rest, unconnected leaves of other manuscripts, written at very different periods, and on multifarious matters. Though to an equal degree no other case similar has been met with, yet few of the palm-leaf manuscripts are accurately complete: many of them here and there wanting a leaf, or more than one. This is a circumstance quite grievous; and I know not how it could be remedied, except by a careful collation of the whole, in a room set apart for the purpose; whereby perhaps the integrity of the manuscripts might to a great degree, if not wholly, be restored.

These difficulties and disadvantages being set aside, I have notwithstanding found an extensive mass of information brought before me, in wading through which, I have been slowly, but systematically, engaged; not looking upon my personal information as an ultimate end; but yet without any very distinct perception of more extensive result. Since the time when the second volume of my quarto work was issued from the press, that is, since December of last year, I have regularly given a portion of time every week to an investigation of the various documents, aided by a native assistant. I select, mark, and get copied (in the way above indicated) whatever appears to be valuable. A considerable mass of papers has thus accumulated, toge-

ther with a number of new and legible copies on palm-leaves, transcripts of the original books. The whole illustrates history, mythology, poetry, manners and modes of opinion: all, as I think, very desirable to be made generally known. I have about one-third of the matter, selected by me, yet to go through; and, though I have begun to translate only in a limited degree, yet it seems to me, that the whole of the matter in my possession ought to be examined before extensive translation is vigorously entered upon. There are also other documents in the Library of the Literary Society, indicated by me at the commencement of this letter, as secondary; these ought not to be neglected.

How to act does not appear to me at present very plain. I have been enabled to give so much time to the matter; and I have not scrupled the expense thus far incurred. I am a solitary individual, engaged in this voluminous affair; and feel my loneliness. At one time, as I mentioned to you, I thought your Journal might be a suitable vehicle for the publication of some portions of these manuscripts. Such I still think may be the case, as regards the lighter and more desultory portions; but the larger, and more important, parts are of a magnitude and character, to which your Journal is quite inadequate, under any circumstances; and more especially as a section only of its contents could, with general acceptance, be so occupied. I have contemplated an additional series of Oriental Historical Manuscripts; but adequate reasons exist to deter me from incurring the risk of the heavy loss that might be the consequence. In a word, I must contemplate nothing decisive, for the present, and wait for some further direction: indeed there is much yet to be done before translation need be made a matter of urgent consideration.

Having lately been occupied with some enquiries connected with the islands of the eastern Archipelago, I was hence led, more than by any other consideration, to take up a Tamil palm-leaf manuscript from the Mackenzie collection, entitled by professor Wilson in his catalogue, and on the label of the book itself, *Marava-Jathi-Vernanam*; being, as its own proper title imports, on account of the local subdivisions and manners of the tribe of *Maravas*, at the extreme point of the peninsula. I suspected a co-incidence in some customs with those of natives of Java and Sumatra; and on carefully translating the document find the expectation not wholly erroneous. It is totally worthless, in any historical point of view; but is of that lighter kind, which I have supposed might suit your Journal. I shall accordingly transmit it to you, to await your pleasure: prefixing to it a slight historical sketch by way of introduction.*

I remain, Sir,

Your obliged, and very faithful servant,

August 27th, 1836. W. Taylor.

* Inserted at page 350.—Ed.

XVIII.—PROCEEDINGS OF SOCIETIES.

1.—Proceedings of the Asiatic Society of Bengal.

Wednesday Evening, 3d August, 1836.

The Government of Madras referred for the consideration of the Society, through the Supreme Government, a proposition submitted by Cavelly Venkata Lacshmia, Pandit, to re-establish the system of Historical Research so successfully pursued by the late Col. Colin Mackenzie in the Peninsula, by collecting inscriptions, manuscripts, grants, &c. as well as to translate and digest the mass of materials already collected, and now in the possession of the Royal Asiatic Society.

Cavelly Venkata had drawn up a report-progress of the researches, in which he states himself to be still engaged, classifying the different dynasties, ancient and modern, of South India, on which light has been thrown by the Mackenzie collection. This paper and the correspondence were referred to the Committee of Papers for their examination and report, previous to discussion of the question in the Society.

Wednesday Evening, the 7th September, 1836.

The following letter from the Honorable G. Turnour was read.

Sir, *Kandy, July* 8, 1836.

Various circumstances have concurred to prevent my presenting the Asiatic Society with the accompanying pamphlet sooner. Its completion has been delayed, partly from want of leisure, and also in some degree from my having entered more fully into an account of Páli Buddhistical literature, and published more of the *Mahávanso* in this volume, than I had designed when I addressed you on the 10th July, last year.

In presenting a copy of this publication to the Governor General and the Governors of the several Presidencies, I have mentioned that I had adopted this preparatory course, with the view of eliciting the criticism of oriental Societies and scholars on this portion of the *Mahávanso*, before the principal work issued from the press; and of thereby, at once, obtaining either a confirmation or refutation of the expectations I entertain as to its pointing out the road to a new and interesting field of research in Asia. It would be satisfactory, therefore, to me, if this pamphlet were referred to the Committee of Papers, for its judgment on it. At the risk of being considered affected, I repeat, that it is on the original work and on the general references thence deduced by me, that I court criticism. I cannot attach much importance to a translation, hastily made, of a work composed in a language which I have hitherto studied rather with the view of gathering information regarding the native institutions, than of familiarizing myself with its philological niceties.

The first volume of the *Mahávanso* has been printed. I have only to recast the introduction, and prepare a glossary, to admit of its publication.

If the contributions to your Journal offered in the introduction (p. 110) would be acceptable; as a preliminary step, I would suggest your transferring to its pages, from those of the Ceylon Almanac of 1836, Mr. Armour's translation of Kitetigama's Essay on Buddhism, as well as his prefatory letter. The author of

that Essay was a Buddhist priest, of distinguished reputation for learning; and Mr. Armour is unquestionably the best European Singhalese scholar in the Island. The comprehensive form in which the system of Buddhism as recognized in Ceylon is presented in that Essay, and the definitions there afforded of particular terms, will both save details of explanations in my analysis, and serve to render it more intelligible.

I have the honor to be, Sir, &c.

To the Secretary Bengal Asiatic Society. George Turnour.

Mr. H. T. Prinsep in reference to the above stated, that the Governor General had empowered him also to solicit the opinion of the Society on the character of the Ceylonese Historical Annals, to guide his Lordship in Council as to the extent of patronage to be accorded to the work by the Government of India.

In compliance with the wishes of the Governor General and of the author himself, Mr. Turnour's Introductory Essay, Historical Epitome and translation, were referred to the Committee of Papers to examine and report their opinion of the authenticity and value of the *Pâli* annals, which the author has undertaken to introduce to the knowledge of the learned world, as well as upon the fidelity of the translation, confronted, as it is, line by line with the Pali original in Roman character.

The Secretary read the following report from the Committee of Papers on the proposition of Cavelly Venkata Lachmi'a, referred by Government to the Society at the last meeting.

Proposition of Cavelly Venkata Lachmi'a, *Pandit, to the Madras Government.*

To His Excellency Lieutenant-General the Right Honorable Sir Frederick Adam, K. C. B., Governor in Council, &c. &c. &c.

Fort St. George.

Right Honorable Sir,

Para. 1.—I have the honor to submit respectfully, the accompanying copy of a letter addressed to your Excellency from the Royal Asiatic Society of Great Britain and Ireland, for the consideration of your Excellency in Council, of which Society I am a corresponding Member, whereby it appears that that Society is very desirous to receive every literary information in this part of the world, with a view to complete the late Colonel Mackenzie's collection. I most submissively solicit, that your Excellency in Council will be pleased to sanction every support from the Government regarding those researches, particularly to authorize me to open a general correspondence with the gentlemen of literary endowments, under this Presidency, in the revenue, judicial and military branches of the service, to enable me to procure every information on the subject of the History, Antiquities, &c. of India.

2.—I beg leave to submit the enclosed copy of an abstract, comprising a brief idea of the nature of the work in which I am engaged. I leave it to your Excellency in Council to judge what may be estimated to be the expense and establishment required to bring it to a completion. It would, however, be presumptive in me, at the present stage of affairs, to suggest any specific amount. But the work consists of twenty-one different ancient alphabets and fourteen languages, ancient and modern, of various parts of the Peninsula; consequently, I would observe, that I will have occasion to employ in every zillah, on the smallest scale, two in-

telligent scholars, one versed in Sanscrit and the other must be proficient in oriental literature, whose office it will be to collect ancient inscriptions from religious structures and holy temples, which will prove the best guide to ascertain the accuracy of the chronology and history of the country. If the collectors undertake a part of this laborious task, I should imagine that it will prove less expensive: yet I am led to fear greatly, that they can hardly afford to give any attention to it, with the exception of some few of the most literary characters. For the materials thus collected, I would require an establishment of pandits, translators, &c. to arrange and bring down such information that may be collected and approved of.

3.—It never can be expected that the postage of the vast correspondence connected with this arduous task, which are necessarily required by the above Society, can be carried on at my own expense; I therefore most respectfully beg the favor of your Excellency in Council to pass all communications to and from me, as a corresponding member of the Royal Asiatic Society, free of postage, in the same manner as was passed in the late Colonel Mackenzie's time, relative to which the enclosed is a copy of a letter from the Post Master General of this Presidency, dated 8th March, 1809, for the information of your Excellency in Council, and in the same manner as the Madras Literary Society is still enjoying this privilege without any interruption, as stated to the President of the Madras Hindu Literary Society, in your Chief Secretary's letter under date 22d February, 1834, which is about *to be discontinued*. But I would faithfully promise that no abuse or advantage shall be taken of the confidence that may be reposed in me on the subject.

I have the honor to be, Right Honorable Sir,

Your Excellency's most obedient humble servant,

(Signed) Cavelly Venkata Lachmi'a,

Corresponding Member of the Royal Asiatic Society of Great Britain and Ireland.

Madras, 16*th June,* 1835.

Report of the Committee of Papers on Cavelly Venkata Lachmi'a's *proposed renewal of Colonel Mackenzie's investigations.*

The reference from the Madras Government, for an opinion on the merits of Venkata Lachmi'a pandit's proposition, however complimentary to our Society, might perhaps have been addressed with better effect to the Madras Literary Society, which must be far better acquainted than we can pretend to be, both with the character and attainments of the individual, and with those desiderata in the History of the Peninsula, which he undertakes to elucidate.

We, however, enjoy one advantage in the possession of Mr. now Professor, Wilson's Descriptive Catalogue of Col. Mackenzie's Collection, which, aided by other published works on the history of the Southern Hindu States, may enable us to form a tolerable opinion on the question.

It might be supposed from the entire silence of Venkata on the subject of Mr. Wilson's labours in the statement he has handed up to the Madras Government of the "Progress of the Researches" *in which he is engaged,* that he was a total stranger to the descriptive catalogue; although the brief notice he gives of each state and dynasty, appears based upon the summary contained in the introduction to that work, both as to arrangement and detail; and certainly it adds not one iota to the information made public by Professor Wilson in 1828.

The object of Sir Alexander Johnston, in persuading the Pandit to found a native literary society at Madras was, doubtless, that through the gratuitous aid

of those best acquainted with the languages and traditions of the country, and having connections or friends dispersed over the Peninsula, the learned world might be put in possession of translations and digests of the mass of MSS. collected by Col. Mackenzie; at the same time that other materials of a similar nature might be sought out and accumulated*. The Vice-President of the Royal Asiatic Society does not seem to have contemplated the organization of an extensive paid establishment of collectors, pandits and copyists; otherwise it is probable he would have addressed himself to the Government itself, either directly or through the natural channel of the Madras Auxiliary Society. For he would have anticipated that such an extensive scheme would need the control of a master head, accustomed to generalization, and capable of estimating the value and drift of inscription and legendary evidence. The qualifications of Cavelly Venkata for such an office, judging of them by his " abstract," or indeed of any native, could hardly be pronounced equal to such a task, however useful they may prove as auxiliaries in such a train of research. The Pandit's *orginal* and *arithmetical* mode of weighing authorities, of which examples may be found in every item of his statement, is any thing but calculated to contradict this assumption. His remarks on the first, or ancient *Nandavarrum* dynasty of *Andhra*, may be cited as an instance:

" As this is a very obscure dynasty, confidence can only be placed in the inscriptions. From the materials already possessed in the collection of Col. Mackenzie, I suppose *one-eighth* of the history of this dynasty is complete, and *the remainder* should be completed by further research."

The Mackenzie Manuscripts (embracing, as Cavelly Venkata says in his letter to Government, using the words of the late Colonel himself†, no less than *twenty-one* different alphabets and *fourteen* different languages) have been for some time at Madras deposited in the College Library. We have no means of knowing whether during that period the pandit (himself a servant of the college)‡ has published or undertaken the translation or analysis of any part of its contents. In the absence of any such testimony of his competence, contrasted with what will be presently urged, it seems impossible to recommend any large outlay of public money in the way he proposes.

Not that it is undesirable to complete the examination of the Mackenzie papers. On the contrary, all who have read Mr. Wilson's catalogue, will grant that to be an object of high, of national importance; especially when it is asserted that many of the volumes are going rapidly to decay§, and may not be available a few years hence. The British Indian Government has spent a lakh of rupees in purchasing these ancient records: to refuse the requisite aid for their examination and conversion to public use when they are known to contain a vast store of curious and interesting matter, would be false economy, only equalled by the case of the Buchanan MSS. in Calcutta, which cost even a larger sum, and which the Government has recorded its unwillingness to print even free of expense, or to take a single copy of it printed by others||.

* See Madras Lit. Soc. Journal, No. 12, p. 173.

† See preface to Wilson's Des. Cat.

‡ The Pandit was never in the employ of the College, nor of the Lit. Society; and, while we are on this subject, we may as well point out that the *College of Fort St. George*, and the *Asiatic Department of the Madras Literary Society*, (whose property these MSS. now are) though the establishments are (or were) in the same building, are totally different institutions.—*Editor Madras Journal.*

§ See Taylor's Hist. Man.

|| See Mr. Secretary Bushby's Correspondence with the Editor of the Gleanings in Science and Journal Asiatic Society.

2.—*Address read before the Bombay Branch of the Royal Asiatic Society, on the 27th January,* 1836. *By the Rev.* John Wilson, *President.*

This Society has now been in existence for upwards of thirty years; and it may not be improper for us, in our present circumstances, briefly to advert to its past proceedings, and to some of the various subjects of inquiry, and especially those connected with our situation in western India, which still invite our attention.

In the discourse delivered at the formation of the institution, by its first President Sir James Mackintosh, that great man declared himself "ambitious of no higher office than that of conveying to India the desires and wants of the learned at home." A more worthy "representative of the curiosity of Europe," could not have presented himself in this country. It must be admitted, however, that, powerful as was his influence, and remarkable as has been the zeal and success of the members in prosecuting some of the objects proper for investigation by an Asiatic Society, their contributions on the topics to which he more particularly directed attention, have not been so numerous and extensive as might have been reasonably expected.

On Natural History, on which he dwells at greatest length, there are in our Transactions only a few distinct contributions, while the subject is only partially adverted to in the papers descriptive of particular districts of the country. This is undoubtedly a matter of regret, for the study, directly conversant as it is with the works of God, and with the intimations which they give of His wisdom, power, and goodness, is, in all circumstances, possessed of the highest interest, and conduces both to intellectual gratification and to moral improvement; and in such a country as India, so vast in its extent, and so grand and multifarious in its productions, it is possessed of peculiar charms. It is a study, in many of its branches, so intimately connected with national resources, and the useful arts, and the means of humane amelioration, that it is powerfully recommended to every economist and philanthropist. It is a study in which most who have received a liberal education may engage, and to advance which, all who give it an ordinary share of attention, may considerably contribute. The sojourners in Bombay have, in the mountains, forests, and islands, in the neighbourhood, innumerable objects, connected especially with Geology, Botany, and Zoology, which both from their comparative novelty, and intrinsic interest invite attention. The Society cannot do better than encourage their investigation, and imitate in reference to them, the laudable procedure of the sister institution in Bengal, with regard to those of a similar nature more particularly connected with that province, and among whose highest honours must ever be, its having numbered among its members such men as Roxburgh and Wallich, and fostered their earliest attempts to unfold the beauties and mysteries of creation. The report of observation and discovery connected with them, if given in this place, would form an agreeable entertainment even to those who may be most ardent and persevering in their researches into the other important objects of the Society's investigation. That a studious attention to both of them, by individuals, is not impracticable, is well evinced in the cases of Jones, and Colebrooke, and Carey, and others, who have been distinguished in India both for their science and literature; and who have been not less remarkable for their knowledge and expositions of the thought and feeling of man, as connected with the objects of

his devout regard, or superstitious reverence, and the language by which he holds communion with his fellows, than for their lively cognizance, and philosophic interpretation, of the varied phenomena of nature.

The Statistics of any country are intimately connected with its Political Economy, and are consequently highly worthy of attention. Their importance was not so generally admitted, as at present, on the formation of our Society; but it is strikingly set forth by Sir James Mackintosh. The tables which he himself presented, connected with the population of Bombay, and the remarks with which he accompanied them, are valuable. Similar ones, of a later date, are desiderata, and when compared with those given by him, would furnish curious information. The Notices of Jambusar and Loni, given in our Transactions, by Drs. Marshall and Coates; and of certain districts of the southern Maratha Country, and of the *Jharejahs*, of *Kach*, in the Journal of the home Society, by Dr. Bird, and Lieutenant Burnes, are good specimens of what is required of other localities and tribes. Without the assistance of our liberal Government, little can be done with satisfaction in this department. Such assistance, by instituting special inquiries, and by delivering up documents already in its possession, or which could be procured by application to its judges, and magistrates, and revenue officers, it could easily, and with great advantage to itself, render*.

Only one paper on the subject of Political Economy, as connected with India, has been laid before our Society. It is by Mr. Bruce, and has been transmitted to England, where it will not fail to be appreciated.

Of all the topics of inquiry meriting attention, that of the History and Present Condition of the People, in the different provinces, in regard to language, religion, literature, science and art, means of support, and manners and customs, is paramount. It is very extensive; and has met, from the members of the Society, with considerable attention.

The *Parsis*, the great body of whom dwell amongst us, present themselves as special objects of inquiry. The history of their original country, has been ably unfolded by Sir John Malcolm; and on its ancient chronology previous to the conquest by Alexander, and its state from the battle of Arbela in A. C. 331, to the rise of Ardeshir Babegan, much light has been cast by our late learned President, Colonel Vans Kennedy. Mr. Erskine's papers respecting them, are remarkably interesting, as containing an able review, and analysis, of the Works of Anquetil du Perron, who followed Dr. Hyde as the expositor of their tenets; the results of his own observation; and valuable disquisitions on their sacred books and ancient languages. The researches of Professor Rask, in his paper given to this Society, whatever may be the opinions formed of the particular conclusions at which he has arrived, and it must be admitted he has reasoned ingeniously in their support, are also interesting. For the original tracts, with remarks, in the course of being published in France by M. Mohl, we owe our gratitude. The History of the Early kings of Persia by Mirkhond, translated by Mr. Shea; and the History of Vartan and the Armenians, by Mr. Neumann; and of the Shah Namah, by Mr. Atkinson, for which we are indebted to the Oriental Translation Fund, contain much historical information

* A proposition has, I understand, been made, by an able and zealous officer of this Presidency (Capt. T. B. Jervis) to the different Governments of India, relative to the periodical publication of the returns of population, revenue, and cultivated and waste lands.

on the religion of ZOROASTER. Still more may be expected from the translation of that singularly curious work, the Dabistan, which is about to appear. The curiosity of the public respecting the Parsis, however, is far from being satisfied, as is evident from the inquiries which frequently reach this place both from London and Paris. We need a more exact translation of the books which they esteem sacred, than that which is furnished by ANQUETIL DU PERRON. Such a translation has been promised by Professor BURNOUF, whose attainments in oriental literature, and ardour in oriental study, afford good ground for hope that our wishes respecting it will be realized. Should he fail, the attempt may be be made in Bombay, where there are still a very few Zand scholars among the Zoroastrians to be found, and whose assistance, as well as that to be furnished by the translations into Gujurathi, may be procured*. We require information particularly on their popular superstitions, and domestic manners and customs, and general habits, as exhibited to the native community, and which, there is reason to believe,, differ not a little from those generally observed by their European acquaintances, and for which they have received, in the opinion of the most intelligent of their own number, a more than *quantum sufficit* of credit. It was with the view of adding my mite to the information possessed on these topics, and not because I conceived it possessed of any intrinsic merit, that I lately presented the Society with a translation of their General SIROZE. There are extant narratives of their settlement and history in India, versions of which should be presented to the Oriental Translation Fund. At a late meeting of the Committee of Correspondence of the Royal Asiatic Society, some of the more liberal natives in Bombay, were invited to form themselves into an association, with the view of aiding in collecting information on some of the topics to which I have now adverted. Little, I fear, can be expected from them, with out the co-operation of European scholars, or without the proposal to them of special queries calculated to direct them in their communications. I am decidedly of opinion that it would be of advantage to both parties, were some of them associated with ourselves; and I would fondly hope that should any of them, possessed of competent attainments and zeal, and a respectable character and influence, ask membership of our body, it should be readily accorded.

There is no institution which has furnished more able and interesting illustrations connected with the Musalmâns than our Society. The question, so interesting in the history of the errors of the human mind, was MUHAMMAD an impostor or an enthusiast, has been discussed by our late President Colonel VANS KENNEDY; and though many may dissent, as I myself do, from the conclusion at which he arrives, the ingenuity with which he conducts his argument, and the varied learning which he displays must be readily acknowledged. The same distinguished orientalist has furnished us with the most correct estimate of the literature of the Musalmâns in Persia, which is extant; and has given us a minute and precise abstract of the Muhammadan Municipal Law, with a constant reference to acknowledged authorities, and with an arrangement particularly luminous, being suggested by that of BLACKSTONE in his Commentaries on the Laws of England. His paper furnishes an important aid to the understanding of the state of Government, and society in general, in Muhammadan countries. The points at issue between the *Shias* and *Sunnis*, and which have been, and still are, the cause of the greatest distractions and animosities among the Moslems, are well illustrated by the trans-

* Six Fargards of the Vandidâd can also be procured in Sanskrita.

lations and remarks of Sir John Malcolm; and the sentiments of the *Sufis* and *Mehdivis*, by those of the late Lieutenant Graham and Colonel Miles. The account of the Akhlak-i-Nasiri, by Lieutenant Frissell, and the translation of one of the discourses of Sadi by Mr. Ross, throw much light on the Musalmán Economics and Ethics, both theoretical and practical. What we chiefly want in reference to the Muhammadan religion, is a fuller account, drawn from a comparison of all the existing authorities, of the state of Arabia at the time of its origin, and from which we could form a more enlightened judgment than we do, of those great revolutions brought about by its author; of the history of its religious influence, distinguished as much as possible from that of the military exploits and civil arrangements of its followers, which have hitherto almost altogether engrossed attention; of the general arguments by which its doctors have urged its pretensions in opposition to Christianity*; of the Bohoras† and other curious sectaries; and

* Some interesting information on this subject, is to be found in the Controversial Tracts, by the Rev. Henry Martyn, and his opponents in Persia, and the preface prefixed to them by Professor Lee, and in the last of the letters addressed to me, by H'aji' Mahammad H'ashim, and published in Bombay. As the discussion of the points at issue, however, is an ancient one, it seems desirable that a collection should be made of the hints respecting it which are to be found in the Musalmán works of theology.

† To any person, whose leisure may permit inquiry into this body of Musalmáns, the following memorandum written by me on a visit to Surat in the beginning of last year, may not be unacceptable. " The Bohoras of Surat are divided into three sects, respectively denominated Ali, Sulimán, and Dáud. In the first of these, there are only five or six families; in the second, about fifty; and in the third, about five thousand, with a population of about twelve thousand. They have accounts of their tribe, one of which I have seen in Arabic, which carry back their history about six or seven hundred years. They generally support themselves by the vending and manufacture of cloths, hardware, household furniture, &c. They profess to be quite distinct from the agricultural Bohoras, who are to be found in the Baroch districts, and of whom a considerable number of families have now also settled in Surat.

" The Bohoras are under the religious, and, to a great extent, the civil government of a Mullá, whose head quarters were originally in Arabia. The Mullá in Surat sits upon a throne, and is highly respected. He is thrice saluted by every person when he is *in cathedra;* and his attendants give him all the attentions which the princes of the land receive when they are in *Darbár*. He has deputies in all the towns in India where Bohoras are to be found, and even in Maskat, Basora, Jadda, and Mokha. He has a very large income, arising principally from donations at births, marriages, and deaths; but from his funds, the poor of the sect, whether resident in Surat or occasional visitors, are supplied. He nominates his successor, having a principal regard to his talents, information, and capacity to govern.

" The Mullá, or Mulláji as he is called by way of distinction, reads the Korán, and addresses the people during five or six days of the Moharram, and one day during the month of Ramazán, when his auditors are numerous. In the part of Surat principally inhabited by Bohorás, there are many courts, in each of which there is a Mullá to conduct worship early in the morning. The people, however, seem most to relish praying at the tombs, or great mausoleums, which contain the sepulchres of some of the ancient Mullás and their relatives. They actually, as we observed, kiss the chunam covering of the graves!

" In regard to marriage, it may be observed, that the number of wives permitted by the Korán is allowed, as in the case of other sects of Musalmáns. The follies of the Hindus have found a place among them, in the manner in which marriages are contracted and celebrated. Girls are espoused at the early age of five years, and without much regard, on the part of their parents, to the age of those with whom they are united. The processions, and feastings, are conducted much as among the other classes of the natives.

of the peculiar practices, superinduced probably by intercourse with the Hindus, of those who profess it in India, and particularly in the provinces with which we are most intimately connected. That the latter subject is not unworthy of interest, will appear to any reader of the work lately published by Dr. Herklots, and to the notices given of certain festivals by M. Garcin de Tassy. From these documents, as well as from Colonel Kennedy's paper on the religion introduced into India by the Emperor Akbar, it appears that the followers of Muhammad, cannot only, when circumstances tempt them, lay aside their intolerance, but accommodate themselves to existing prejudices, and indulge in the boldest speculations. In the almost universal neglect of historical records by the subjugated Hindus, we must principally look to the Musalmáns for any historical information connected with this country which refers to the times which intervene between the commencement of their conquest, and that of the European powers. The History by Ferishta, translated by Colonel Briggs, though neither, as was to be expected, very philosophical nor rigid, is valuable. Captain Rowlandson and Dr. Bird, have done well to translate two works which treat of the history of Malabar and Gujerat. They contain much interesting information. Another history of the latter province, by a very intelligent Bráhman, but principally from Muhammadan authorities, and which may prove worthy of translation, was lately presented to our Society by our zealous Secretary. There are materials to be found, in different places, sufficient to throw light upon the principal occurrences in almost every province of India.

Of various tribes of the Hindus, as the Katis, the Bhìls, the Banjaris, the Pandu Kolis, the Dakhan Kunbis, and the Karadi Bráhmans, and the inhabitants of *Sindh*, very curious notices are to be found in our Transactions. Of many other tribes, accounts have appeared in separate publications.* Many more, however, with marked natural peculiarities, and in a strange social state, still remain to be described. Those who are found resident in the jungles, and in mountainous districts, and who are probably the remains of the Aborigines of the country, are particularly worthy of investigation. Attention to them is called for, by all who desire to advance their civilization, and to elevate them from their present degradation. Description must precede any considerable efforts made for their improvement. Perhaps some similarities may be discovered in their language, religion, and customs, which may lead to important conjectures as to the ancient history of India. Of many of them it has been already ascertained, that they have had no connexion with Bráhmanism, except in so far as they may have felt its unhallowed influence in excluding them from the common privileges of humanity, and banishing them to the wilds, or dooming them to ignorance, and unwilling and unrewarded servitude†.

" The shaving off the hair, which is viewed as a kind of sacrament, is performed on the 7th or 21st day after the birth, either of a son or daughter.

" Expulsion from caste follows the practice of gross immoralities, and particularly the drinking of ardent spirits.

" Funerals are conducted with considerable solemnity. Those of the higher classes are attended by the Mullá."

* Among the fullest, and most interesting of these, is the History of the Rámoshis, lately published by Captain Mackintosh.

† See particularly Mr. Baber's Answers to the Queries of a Committee of the House of Lords on the state of Slavery in the South West of India.

Though on the Hindu religion and literature in general, our publications contain rather scanty observations, some of our members have added greatly to the information communicated by the distinguished literati of the other side of India, and of Europe. Our Society was the first body to submit to the public a proposal for a union for the promotion of translations from the Sanskrita. Its claim to this honour, it is right again to re-assert. It will be established by a reference to a letter addressed to the Asiatic Society of Bengal, in 1806, by Sir James Mackintosh, and published as an appendix to the first volume of our Transactions*. Such translations were practically encouraged by the Society itself, in the case of the Liláwati, a treatise on Arithmetic and Geometry by Bhaskara Acharya, and the Prabodh Chandrodaya, a curious allegorical play illustrative of the opinions of the Vedantikas, and both published by the late Dr. John Taylor. The first general account, of any considerable size, of the Hindu Pantheon, is by one of our members, Major Edward Moor. In Colonel Kennedy's Ancient and Hindu Mythology, we have a work, than which none more important, if we refer either to original quotations from the *Shástras*, or learned disquisitions, has yet appeared. I make this remark with the more freedom, that circumstances called me, on the publication of the work, to animadvert on the estimate which it forms of the moral character of Bráhmanism in a manner which gave the learned author offence. In the Essay on the Vedanta by the same gentleman, we have the best account of that very curious system of speculation, considered in a philosophical point of view, which has yet appeared,—an account which proves it to be a system of spiritual pantheism, and as such entirely different, except in occasional expression, from that of the Mystics of Europe, to which it had been maintained to be similar by Sir William Jones, and other writers†. It was in this place that the first defence, by a Native, of both the exoteric and esoteric systems of Hinduism, in reply to those who seek to propagate the principles of our Holy Faith, appeared; and it was here that a rejoinder, embracing briefly the consideration of both these subjects, was published. About two years ago, a portion of the *Rigveda*, the most considerable which has yet been printed, was published in *Sanskrita*, *Marathi*, and English, by one of our members. A translation of the whole of this work, to which I believe Prof. H. H. Wilson has turned his attention, and of the *Bhagawata Purána*, which, though it cannot claim an antiquity much exceeding that of six hundred years, is certainly the greatest practical authority at present, at least in the West of India, are greatly to be desired. On the different sects of the Hindus, and on their provincial superstitions, much light has yet to be cast. On the North of this Presidency, we have the *Vaishnavas;* in our immediate neighbourhood, the *Smartas;* and in the South, the *Shaivas* or *Lingavants*, in

* Page 310.

† In the works of the Mystics, and of the pious writers, to whom Sir William Jones alludes in the course of his reasonings, there are figures of speech, and other expressions, very similar to those used by the Vedántists. Others, still more strikingly similar, could easily be produced. I give one from the Poems of Richard Baxter.

"But O! how wisely hast thou made the twist!
To love thee and myself do well consist.
Love is the closure of connaturals;
The soul's return to its originals:
As every brook is toward the ocean bent:
And all things to their proper element:
And as the inclination of the sight,
How small soever is unto the light:

the practice of all their peculiarities. In the Dakshan, we have a general worship of deified heroes, as yet unnoticed, except in the most incidental manner. Many curious classes of mendicants, of whom little or nothing is known*, are to be found within the sphere of our peculiar observation. The religion of the Jainas, on which most valuable manuscripts, procured by Mr. WATHEN, are deposited in our library, is still, in many respects, to be unfolded. Our Transactions have only one paper, by Captain McMURDO, which refers to it. In the possession of the Jainas, there are many works calculated to throw much light on the religious history of India in general, with the use of which some of them would not be unwilling to favour a European student. I fondly trust and believe, that there are among our members, those who will continue to contribute, as circumstances may call them, to the exposition of the systems of faith, which have so long exercised their sway in this country, and the various literary works, which, though, unlike those of Greece and Rome, they are of little or no use in the cultivation of taste, are valuable as they illustrate the tendency of these systems in their connexion with social and public life, and as they explain a language the most copious in its vocables, and powerful in its grammatical forms, in which any records exist. Destitute of a knowledge of these systems, and the works in which they are embodied, the native character, and the state of native society, will never be sufficiently understood, a right key obtained to open the native mind, and all desirable facilities enjoyed for the introduction among the people of a body of rational and equitable law, and the propagation of the Gospel and the promotion of general education. There are some respectable patrons of the latter supremely important work, who overlook its importance; but their number is on the decrease. They ought to consider that the situation of those to be instructed, is to be attended to, as well as the instructions to be delivered. While divine truth must be propagated with unwavering fidelity, and all hopes of ultimate success rest on its own potency, its suitableness to the general character of man, and the assistance of divine grace, judgment ought to be employed in the mode of its application to those who vary much in their creeds, and differ much in their moral practice. We have

As the touch'd needle pointeth toward the pole ;
Thus unto thee inclines the holy soul :
It trembleth and is restless till it come
Unto thy bosom where it is at home."

No person who is familiar with the *Upanishads* can fail to mark the coincidence of the the language of BAXTER in the preceding passage, with that of the Transcendentalists of India. This coincidence of language, however, does not warrant the inference that there is the least agreement of statement. In proof of this position, we have merely to quote the lines which follow those now given.

" Yet no such union dare the soul desire
As parts have with the whole, and sparks to fire ;
But as dependent, low, subordinate,
Such as thy will of nothing did create.
As tendeth to the sun the smallest eye
Of silly virmin, or the poorest fly.
My own salvation when I make my end,
Full mutual love is all that I intend,
And in this closure though I happy be,
Its by intending, and admiring thee."

* Of one of these, the *Mánbhavas*, whom I had particularly in view in making this remark, I have just received an interesting account from Captain A. MACKINTOSH, the author of the History of the Ramoshís.

the highest authority for an accommodation such as that for which I plead. Though the great truths proclaimed by the apostle Paul were the same in all circumstances, they were introduced in very different ways to the Jewish Rabbis and people, and to the members of the Athenian Areopagus. I must hold, that there is no little unsuitableness in India, in addressing a Pantheist as a Polytheist, and *vice versa:* in speaking to a Jaina as to a Brahman; in condemning that at random which the natives may suppose to be unknown, and in using theological terms, and general phrases, without any very definite sense of their application by the natives themselves. The more a knowledge of Hinduism and of Hindu literature is possessed by any teacher, the more patiently and uninterruptedly will he be listened to by the people, and the more forcibly will he be enabled, and principally by contrast and concession, to set forth the authority, and the excellence, of the doctrines of Christianity.

In connexion with the subject to which I have now adverted, I may allude to the peculiar duty which devolves on us of collecting Sanskrita manuscripts. They are to be found in a purer state in the Dakshan than in any other part of India, and the poverty of the Brahmans leads them readily to part with them. Those which were lately purchased by us are very valuable.

The contributions of the members of our Society to the elucidation of *Hindu Antiquities,* have done much to extend and support its credit. The proximity of the ancient excavations, which may be classed among the wonders of the world, could not fail to excite curiosity and inquiry. The descriptions and illustrations of those of *Gharipur* (Elephanta), *Sashti* (Salsette), *Karali* (Carlee), *Verula* (Ellora), *Bag* and *Ajanta**, though a few errors and oversights may be detected in them, are highly interesting. Mr. Erskine has satisfactorily shown the distinguishing characteristics of those of them which are respectively to be attributed to the Baud'dhas and Jainas, and the Brahmans. It is to be hoped that the inscriptions which are to be found on some of them, and which are in the Sanskrita language, and in ancient characters very similar to those which have lately been published in the ably conducted Journal of the Asiatic Society of Bengal, will be soon understood. The Rev. Mr. Stevenson has already been successful, to a great extent, in decyphering, and translating those of the temples of Karali, and thus leading to inferences by no means unimportant. Some of those of Kanadi, on Salsette, I should think, from a partial trial, present no greater difficulties than those which have been already overcome. The stone bearing the inscription of the temples at Elephanta, we learn from Diego de Couto the Portuguese Annalist, was sent to John the Third of Portugal about the year 1534, and is probably now either in the Royal Museum of Lisbon, or in the University of Coimbra. The Royal Asiatic Society may, without difficulty, procure a transcript. There are excavated temples in the country, such as those of Nasik, and Junar, and others which have been erected, such as those of Abu, Palatina and Girnar, which have not yet been particularly described. What we principally require in reference to them all, is information as to the time at which, and the views with which, they were constructed; an estimate of them as works of art, or as indicative of the resources of those to whom they are to be ascribed; and an inquiry into the religious rites and services, for which they have been appropriated, and the moral impressions which they seem fitted to make on those resorting to them. They are worthy of attention only as they may illustrate the civil and religious history, or practices, of the country. The grants of land, engraven on copper-plates, many of which are still to be found in different parts of the country, are next to them in importance in the advancement of antiquarian research. One of these was trans-

* Written by Messrs. Salt, Erskine, Colonel Sykes, &c.

lated by Dr. TAYLOR. Mr. WATHEN has been successful in decyphering the most ancient of those in our museum; and the results, as stated by him in his communication in the Journal of the Asiatic Society of Bengal for August last, are both curious and useful. Ancient coins are occasionally found in different parts of the Presidency, and the Native States to the northward, which may aid in the correction, or enlargement, of such Genealogical Tables as have been lately published by Mr. PRINSEP of Calcutta*.

There is a small body of *Armenians* in Bombay, from which something interesting might be learnt. A dissertation by one of them on the antiquity of their native language, with notes by Mr. DICKINSON, has lately been transmitted by us to the Royal Asiatic Society, and cannot fail to be acceptable. There cannot be a doubt that the Armenians can fill up important blanks in our Church History, which, to the undue neglect of the orientals, is principally formed on the authority of the Roman and Byzantine Fathers.

The *Beni-Israel* of Bombay, and the adjoining territories, amount to about eight thousand. It is to be regretted that no considerable account of them has yet appeared, particularly as they have been long settled in the country, refuse the appellation of *Jew*, and are probably a portion of the Ten Tribes, never amalgamated, as the body of them probably was, with those of Judah and Benjamin.

The researches of our members on antiquities, and other subjects of observation and rational inquiry, have not been confined to India ; but I cannot longer detain you by alluding either to their results, or by attempting to form, what is unnecessary, and what in me would be presumptuous, an estimate of the enterprise and intelligent observation and research of our MALCOLMS, ELPHINSTONES, POTTINGERS, RICHES and BURNESES. The contiguity of our Presidency to Persia, Arabia, and Egypt; and the prospect of increased intercourse with these countries, by steam navigation, afford ground to hope that our geographical and historical knowledge of them will ere long be greatly enlarged. There is scarcely a country of Asia, which, even, in our present circumstances, does not furnish visitors to Bombay, who prove themselves ready to communicate to intelligent inquirers, information on places never as yet surveyed by any modern European traveller. Mr. WATHEN has been able, from conversing with Muhammadan pilgrims, to prepare a brief, but interesting, memoir of Chinese Tartary.†

I owe to the meeting an apology for the many imperfections of the sketch which I have rapidly taken. I have rather endeavoured to mark our progress, than to point out, what would perhaps have contributed more to our encouragement, the advantages and means of further advancement. Our Society, I may be permitted to hope, will soon again be inspired with its pristine zeal, at the same time that it is directed by its accumulated experience; maintain the character which it has earned for itself; and prove not unworthy of its incorporation with the Royal Asiatic Society of Great Britain and Ireland, an incorporation which must be admitted, notwithstanding some disadvantages, to be beneficial, as it secures that literary sympathy and communication which is greatly to be valued, and the circulation of our papers, with no expense to ourselves, and now in a convenient form, throughout the world.

* Such coins are occasionally worn as personal ornaments by natives, who have no idea of their value.

† See Asiatic Society's Journal for December, 1835.

XIX.—Extracts.

Sketches of the Meteorology, Geology, Agriculture, Botany, and Zoology of the Southern Mahratta Country.—By Alexander Turnbull Christie, M. D.

(From the Edinburgh New Philosophical Journal.)

(Continued from page 193 of the preceding number.)

Geognosy.—The geognostical arrangement of the rocks of the Indian peninsula is everywhere very simple; and a great uniformity prevails throughout the whole country, from Cape Comorin, even as far as the Ganges. The same formation, in many instances, extends uninterruptedly, for several hundred miles in the same direction; and, consequently, that great variety, and those frequent changes within a short distance, which are so conspicuous in Britain, are seldom met with among the rocks of India.

The principal rocks in the peninsula of India are granite, transition rocks, old red sandstone, trap rocks, and, superior to all these, a ferruginous claystone. The Darwar district, and the adjoining coast, contain specimens of all these rocks; and will, therefore, serve as an example of the general geognostical structure of the peninsula.

Granite.—This appears to be the most abundant rock in the peninsula of India. It stretches, with few interruptions, from Cape Comorin to beyond Nagpore and Ellichipore, occupying a great part of the Carnatic, Malabar, and Mysore, nearly the whole of the Nizam's dominions, and a large part of Barar.* It is also met with in many places still further north, namely, in Malwa†, Bundelcund‡, and in the neighbourhood of Delhi§; and Lieut. Gerard found some of the highest of the Himalaya mountains to be principally composed of it||.

All the eastern part of the Southern Mahratta Dooab, from the Sungum¶ of the Kistnah and Tumboodra, to near the British frontier, consists of granite; but west of that, namely, in the British territory, it only occurs occasionally, protruding in a few spots through the schists by which it is covered. It also occurs in the southern parts of the district; the Mysore granite extending, in some places, as far as, but seldom much beyond, the frontier. But although it be met with in comparatively small quantity in this district; yet, considering its very great importance as connected with the general geognosy of India, I

* I state this principally upon the authority of the late Dr. Voysey, whom I met at Hyderabad, in 1823; and I myself travelled through a great part of the Nizam's dominions.

† Vide Malcolm's Central India, vol. ii. Appendix.

‡ Vide Transactions of the Wernerian Society of Edinburgh, vol. iv. p. 26.

§ Vide Transactions of the Geological Society of London, New Series, vol. i. p. 1, 2.

|| Ibid. p. 127. *et seq.*

¶ Sungum signifies the angle of land formed by the junction of two rivers.

will not confine myself to the appearances exhibited by the few specimens met with here; but will also avail myself of the observations I have been enabled to make on the granite in other parts of the peninsula.

The granitic tracts of India exhibit the same general features as granitic countries in other parts of the world. Rugged hills, with bold denticulated outlines, lie heaped together in the greatest irregularity, or occasionally form an obscure ridge, the crest of which, when interposed between the spectator and the evening or morning sun, presents the most fantastic forms. Some of these ridges, when their dark outline is seen at twilight, against a ruddy western sky, emulate, in their varied forms, the capricious shapes of summer clouds; and we can then trace along their summits the appearances of castles, trees, men, and various fantastic groups. Many of the hills have the appearance of collections of large fragments of rock thrown confusedly together by some convulsion of nature; while frequently larger masses, piled with great regularity on each other, look like the gigantic remains of cyclopean architecture. Huge insulated masses, forming considerable hills, in many instances, rise abruptly out of a plain, to a height of several hundred feet, and present nearly perpendicular faces on several of their sides; thus affording situations of immense natural strength, which have almost invariably been taken advantage of by the natives for the erection of forts. These insulated hills are generally met with at the edges of the granite tract, where it is succeeded by the transition rocks; and being situated in the midst of very extensive plains, when they are seen from some distance, they have exactly the appearance of rocky islands in the midst of the ocean*.

The hills have very often a mammillary form; their sides being bare and smooth, and having generally large detached plates resting upon them, which appear as if they would the next moment slide down the smooth surface into the plain below.

The valleys are irregular, are strewed over with fragments and immense rolled masses of granite, and sometimes afford the most picturesque scenery. Notwithstanding the barren nature of granitic soil, the country is, in many places, covered with jungle†.

Upon a superficial examination, the granite of India might be pronounced to have several distinct structures, such as the stratified, tabular, columnar, &c.; but all of these may (I am convinced, from pretty extensive observation) be referred to the laminar; the laminæ giving rise, by the infinite variation in their direction, form, thickness, extent,

* Some of the strongest forts in India are of this description, for instance Chittledroog, Gooty, Copaldroog, Eidgheer, &c.

† Several species of custard-apple (*Annona*) grow in great abundance in the jungles of Hyderabad; and even, in the driest season, their fruits attain great perfection.

and mode of disintegration, to the different appearances alluded to. The most common variety appears to be the curved laminar; the laminæ varying in their thickness from a few inches to many feet, and almost infinitely in the degree of their curvature. The bare mammillary shaped hills and knolls, which are so common throughout the granitic tracts of India, owe their origin to the curved laminar structure of the granite. They have almost invariably loose angular plates resting on their sides, which have arisen from the most superficial of the laminæ having split, and separated from those beneath*.

The laminæ are sometimes straight, but seldom to a great extent; for if traced to a short distance, it will generally be found that they soon lose their straight direction, and become curved. These straight laminæ (as might be expected) vary in their dip, from horizontal to vertical.

The granite, on one side of a small hill at Shawpore near the Beema, has somewhat the appearance, when seen in a certain direction, from a little distance, of being columnar; but when it is examined more closely, it becomes evident that this appearance arises from the following circumstance. The laminæ of the granite, on that side of the hill, are straight and vertical, and had formerly made a very rapid curve at the top. By the influence of the weather, the curve had been worn away, and had thus allowed the inferior vertical parts of the laminæ to separate a little from each other; and, accordingly, when seen transversely, they have somewhat of a columnar appearance.

The laminæ of the granite are very often divided by natural joints or seams, which, in some instances, give rise to an obscure prismatic structure. These seams becoming widened by the action of the weather, and many of the separate masses, owing to their more perishable nature, having been disintegrated and removed, many of the peculiar features of the granite, already described, are thus produced.

A very interesting variety of these seams is met at Chundergooty, on the north-western frontier of the Mysore country. A small range of low undulating hills is composed of the common curved laminar granite; the laminæ of which vary from several feet to a few inches in thickness. Parallel to the direction of the range, namely, south by west, the granite is divided by vertical seams, which maintain the most perfect parallelism throughout their whole extent; and thus, were we to leave out of consideration the laminar structure, they might be said to divide the hill into regular vertical strata. The superficial laminæ have, in many places, separated at the seams, and by exposing those below, have afforded a proof that the seams extend through the whole

* Bellary hill, some of the hills at Anagoondy, and Moul Alley hill, near Secunderabad, are good examples of these appearances.

mass of the hill. This granite is, in some places, penetrated by small veins of quartz, which, on approaching a seam, leave their original direction, follow the course of the seam for a greater or less distance, and again abruptly leave it.

The two surfaces of the laminæ are often perfectly parallel; and when they are not of a great thickness, they can be very easily raised in slabs of any size, for architectural purposes. It is seldom, however, that they are of precisely the same thickness for any great extent; and sometimes this varies prodigiously within a very short distance. In some instances of this description, the granite loses its laminar appearance. Thus, when a lamina becomes very rapidly thinner, so that its two surfaces meet, it acquires the shape of an immense wedge, which is not unfrequently met with. In such cases, the term laminar is rather inapplicable. At the same time, it must be remembered, that these are extreme instances, which are connected by many intermediate links to the most perfect form of this structure. Although, therefore, we would not apply the term laminar to these cases individually, yet it is perfectly evident that it is quite accurate as a general term, applied to the prevailing structure of the granite of India; and that, when we analyze the various appearances which the granite presents, they may be all considered as varieties and modifications of this structure.

There are several instances, in the Hyderabad country, of huge natural columns, formed of four or five separate masses of granite, piled with great regularity on each other, with part of their surfaces accurately adapted. These, in some instances, occupy the summits of gentle hills; and from all the appearances connected with them, it is perfectly clear that the different masses continue to occupy their original situations. The following is probably the manner in which this curious appearance has, in many cases, originated. In a hill of laminar granite, it is evident that if the laminæ be liable to be split and disintegrated by the action of the weather, those parts which rest on the sides, would be more liable, from their inclined position, to be worn down, and to slide into the neighbouring valley, than that part which rests horizontally on the summit; and were the upper mass to be left, it would protect the portions immediately below it, while the other parts were gradually disintegrated and removed; and thus a rude column, composed of a number of separate blocks of granite, would be formed. As the different masses rest horizontally on each other, and have their surfaces (except where these have been much acted upon by the weather) accurately adapted to each other, we cannot for a moment suppose that they have been conveyed from a distance, and arranged in this manner merely by chance. On the other hand, we have every reason to conclude, that they are the slight remains of

laminæ, the other parts of which have been gradually worn down all around them ; and that they now stand as monuments of what the height and nature of these laminæ formerly were.*

It is by no means uncommon to meet with a vein of quartz, felspar, or trap, passing from one loose block of granite into another, or from a hill into a mass, resting loosely upon its surface ; which clearly prove that these continue to occupy the situations in which they were originally formed. Upon a superficial view, one is naturally led to suppose that the confused heaps of granite blocks are the result of some great convulsion of nature. But by merely tracing the small veins of quartz, felspar, &c. which traverse the granite from one contiguous block into another, and by attending to the accurate adaptation of some of the contiguous parts of these blocks, we can prove that a great proportion of them continue in their original situations ; and that all the appearances of confusion which they exhibit, are the result of a partial and irregular disintegration. It is only in the valleys that transported masses are found. We have generally reason to conclude, that all the separate masses, on the sides and summits of the hills, continue to occupy their original places, however confused these may now appear.

We have no reason to suppose that all the granite which has been disintegrated and washed away, was of a hardness and durability equal to that of the masses left entire. Had this been the case, their destruction would have required a length of time, which our imagination cannot embrace. But, it is quite evident, that the perishable granite of loose texture, which is so very common, has alone been removed ; and this removal, by depriving the more solid masses of its support, has caused many of them to split, and be precipitated into the neighbouring valleys.

The distribution of the perishable granite is often very irregular; and, in this case, when removed, it must necessarily leave the solid masses with which it was associated in the most fantastic situations ; and thus we can imagine how many of those appearances of confusion met with in the granite of India may have been produced. We can sometimes perceive how the original laminæ might be renewed, by filling up the void spaces between the different masses, and thus connecting together what were formerly distinct portions of the same lamina.

In regard to the mineral composition of the granite, it may be said (speaking very generally) to consist of felspar, quartz, mica, and horn-

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* A very clever drawing of a singular column of this kind, from the pencil of Lieut. Lawford, of Engineers, is before us, sent by Lieut. Newbold, as an illustration of some notes on the geology of the Bellary district.—*Editor Madras Journal.*

blende ; but it is very seldom that all these ingredients are found associated in one specimen. Sometimes one ingredient, sometimes another, is wanting, which produces a very great number of varieties. By far the most common is that composed of quartz, felspar, and hornblende,—the sienite of Werner. The felspar is in some instances white, in others red. A great part of the Indian peninsula, therefore, consists of a rock precisely similar to that found in the famous quarries in Egypt and it has the same geognostical situation ; for we are told by Daubuisson* that the latter, like the Indian rock, is associated with granite.†

The ingredients vary very much in their proportions and colour ; and thus produce varieties that occur within a short distance of each other, in the same lamina. One variety is sometimes found passing imperceptibly into another, penetrating it in the form of a vein, or imbedded in the form of a nodule.

A very interesting variety is found associated with the granite at Roan, in the Darwar district‡. It consists of a very dark red felspar, with small disseminated crystals and minute veins of quartz ; and, what is curious, there are numerous small vesicular cavities throughout the felspar, some of which are lined with very minute crystals, apparently of chlorite. It would be interesting to ascertain the exact relation which this rock bears to the granite, a point which I myself had not an opportunity of examining.

A very beautiful rock is found associated with the granite at Gudjundergbur. It is a sort of greenstone porphyry ; the basis being greenstone, and containing large crystals of red felspar.

The Indian granite is generally small granular. I have only seen one specimen of large-grained granite in India, which had been brought from Mysore, and was composed of felspar, quartz, and mica.

At the falls of Garsipa there is a variety of granite, which differs from the common granite of India. It is not so old a granite as the latter ; is composed of small grains of white felspar, quartz and mica ; has, in some instances, a slaty appearance ; and is associated with gneiss and hornblende schists. These rocks, being perfectly bare, can

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* Traité de Geognosie, tom. 11. p. 20.

† This is, consequently, the *sienitic granite* of Macculloch and Dr. Benza, being associated with *primary* rocks, and composed of the minerals specified above; *sienite* may be similarly constituted, but is of a later geognostic position, and associated with porphyries, with greenstone, basalt, and the other overlying rocks of the trap formation. It is quite essential that this perspicuous and simple distinction should be observed.—*Editor Madras Journal.*

‡ I am indebted to Walter Elliot, Esq. for the specimens of this rock which I possess.

be very easily examined. They all occur within a space of a few hundred yards. I observed several varieties of the hornblende rock. One consists almost entirely of hornblende ; a second contains disseminated crystals of felspar ; a third contains mica and felspar ; a fourth has more of the characters of actynolite than hornblende ; and a fifth contains so much mica, that it appears to be almost entirely composed of it. All these varieties, with the gneiss and granite, pass insensibly into each other. They are distinctly stratified ; have a dip of about 30° ; and their direction is nearly E. S. E. They form the sides of the chasm, over which the river is precipitated at the falls of Garsipa ; and the depth of which, as already stated, is nearly one thousand feet. This is the only place in India where I have met with primitive gneiss ; but it is not improbable that it occurs in many other parts of the country. We are told by Dr. Davy, that the greater part of Ceylon is composed of it* ; and it is also found in the Himalayas†.

Quartz veins are very common in the granite. They are sometimes so small as to be capable of being exhibited in hand specimens. Sometimes they are of such a magnitude as to form ranges of hills, which may be recognized at a great distance by their white colour. These hills appear to have originated from the indestructible nature of the quartz having enabled it to withstand the attacks of the weather ; while the more perishable granite was worn down all around it. There are two conspicuous ridges of quartz which appear to have been formed in this way, in the vicinity of Hyderabad. One is near the British native cavalry lines ; the other is near the town of Shumsabad. Drusy cavities, lined with very beautiful amethysts and rock-crystals, are sometimes found in these hills. The granite, in the vicinity of these veins, often passes gradually into the quartz, by losing its other two ingredients.

Trap is very common throughout the granite tract of India. It is found both in veins and in extensive overlying masses.

The veins which traverse the granite, present two distinct kinds of trap. One is precisely similar to the most common kind of the secondary or overlying trap, viz. a greenstone of a perishable nature, and having a concentric lamellar structure. It therefore most probably belongs to that formation. The other is more compact, has a rhomboidal structure, occurs generally in smaller veins, and is much more durable.

Large accumulations of granitic debris are met with all over the granite tracts of India. In many places this debris has so completely consolidated, simply by means of the aggregation exerted between its

* *Vide* Transactions of the Geological Society of London, Vol. V. p. 314.

† *Vide* do. do. New Series, vol. 1. p. 132.

particles, as to form a hard rock‡. This rock, in some instances, exhibits an obscure schistose structure.

Granite is not generally employed as a building stone in India, on account of its great expense; but large slabs of it are sometimes brought into the bazars for sale by the Wudrahs,* and are used for paving the floors of the verandahs in the better sort of native houses, and other similar purposes. It is also hewn into hand-mills, for grinding corn ; two or four of which are a load for an ass or a bullock ; and are thus carried to the bazar for sale†. These are the primeval mills of all countries, which are mentioned in Scripture, and are still common among all uncivilized nations.

The ancient Hindoo temples at Anagoondy, now partly in ruins, are built of grey granite, or rather sienite. The massive and gloomy style of architecture which characterises all Hindoo buildings, is also met with here ; but, in one instance, it has, to a certain degree, been departed from ; for, in one of the principal buildings, there is an extensive colonnade, the columns of which are light, with small pedestals and capitals, and approaching somewhat in their proportions to the Grecian. Some of the pillars are tastefully carved with flowers. A few are in the form of caryatides. They support immense slabs of granite, which are carved on their under surface, so as to form an ornamental roof. The largest of these slabs, which are in the central part of the building, are at least thirty feet long‡. The laminar structure of the granite has probably been taken advantage of in the formation of these slabs; for a slab of almost any thickness may be easily detached from its native situation, and then cut into the required form, and of the necessary length and breadth.

It would appear, from a paper by Dr. Kennedy, in the 8th number of Brewster's Journal, that the natives of India have a method of polishing granite, which communicates to it a black colour. In this, I am pretty sure, he must have been deceived, and that he has mistaken trap for granite. Trap is extensively used in India for architectural purposes, and for statuary. Most of the temples at Anagoondy, as already mentioned, are built of grey granite, which perfectly retains

‡ Kirwan mentions an instance of *an artificial* accumulation of granite sand having so completely consolidated, by means of a simple aggregation between its particles, as to form a rock so hard as to be impenetrable by water.

* A vagrant class of people, somewhat resembling the Gypsies.

† This brings to mind the following passage of Virgil :—

> " Sæpe oleo tardi costas agitator aselli,
> Vilibus aut onerat pomis : *lapidemque revertens*
> *Incusum*", &c.

‡ I cannot positively state their exact length ; for I attempted to ascertain it simply by pacing across the building ; but I am confident they are not less than thirty feet long.

its natural colour. Some, on the other hand, are built of greenstone, and are consequently black.

The Hindoos polish all kinds of stones by means of powdered corundum, mixed with melted lac. The mixture being allowed to cool, is shaped into oblong pieces, of three or four inches in length. The stone is polished by being sprinkled with water, and at the same time rubbed with these oblong masses; and the polish is increased by masses being used successively with finer grains.*

Transition Rocks.—These rocks occupy a very large part of the Darwar and Canara districts, and of the territory of Goa. They extend from the eastern and southern parts of the Darwar district, where they succeed the granite, to the western foot of the ghauts, being, in a few spots only, interrupted by the granite, which protrudes from beneath them. On the coast, they are concealed by the ferruginous claystone; but, in a few places, are seen cropping out from beneath it. In some parts of the ghauts they are covered by the same claystone, and by trap rocks. In the northern parts of the Darwar district, they are only seen in the bottom of the valleys, which intersect the sandstone hills. In the central and southern parts of the district they are only covered by the black soil, called Cotton Ground, which there forms extensive plains, and will be afterwards described. To the west of Darwar the transition rocks form parallel ranges of hills, having a general direction of south-east, which is the same as that of the strata of which they are composed.

The principal rocks of this series are clay-slate, chlorite-slate, talc-slate, limestone, greywacke, gneiss, and quartz rock. The strata appear to have a general direction of north-west and south-east. They are generally highly inclined, and, in many instances, quite vertical.

Clay-Slate.—A great many varieties of this rock are met with in these districts. Its principal colours are grey, blue, greenish, red and white. The grey variety appears to be the most common. I have

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* There can be no doubt that Dr. Christie is right in his opinion, and that trap and not granite, is the stone used in India for architectural purposes, which, when polished, is of a beautiful black colour. The Rosa, or mausoleum of Ibrahim Adil Sha, at Beejapore, is composed of a stone of this kind, containing a large proportion of hornblende, and retains its original beautiful polish to this day. Also the exquisite little mosque, within the citadel at the same place, called the *Mecca musjid*, which has a glossy black polish, as if given only yesterday. Beejapore is in the midst of the trap formation of the Deccan, and no other stone is employed, or to be met with, there.—*Editor Madras Journal.*

met with it near Kulladghee, a few miles from Darwar, at Hoolgoor, along the river Mulperba, and in Soonda. At Kulladghee it contains beds of white quartz, in which I found specimens of copper-green. It has sometimes a greenish colour, and a blue variety is occasionally associated with it, which very much resembles roofing slate; but has seldom its hardness. It is also associated, in some places, with a rock closely resembling the greywacke slate of the south of Scotland.

The red and white varieties of the clay-slate occur in very considerable abundance in these districts. They extend for several miles around Darwar, where they are associated with quartz rock. They are found a little to the north of Kulladghee; and I met with them also near Holvully in Soonda. They may be said generally to consist of felspar, more or less coloured with iron, and having a loose aggregation. Some varieties, however, are intimately mixed with quartzy particles; which gives them a great degree of hardness; and they thus gradually pass into the quartz rock with which they are associated. The white variety is frequently so pure, that, in hand specimens, it would at once be pronounced to be a pure porcelain earth. This variety is found in great abundance at Darwar; and it might, I have no doubt, be very advantageously quarried for the purpose of being manufactured into procelain ware. It has an obscure slaty structure. The red varieties with which it is associated, are distinctly slaty. There is a gradual transition from the purest white kind, to those having a deep red or brown colour. A light purplish colour is also sometimes met with.

At Darwar, these rocks are distinctly stratified. The strata are nearly vertical; and their direction is north-west and south-east. No single variety forms a continuous bed of any extent; but, on the contrary, several varieties are often found within a very short distance of each other, in the same stratum; and they are almost always traversed by thin veins of a brown quartz. In addition to the strata seams, these rocks are generally traversed by other parallel seams, which cross the strata, and thus, in some instances, give rise to large rhomboidal masses. So parallel and distinct are these transverse seams, which are seen in some of the large wells at Darwar, that they might, on a superficial view, be readily mistaken for the true stratification.

Owing to the soft nature of these clay-slates, wells can be very easily dug at Darwar; and several that were dug, during my residence there, to a depth of at least seventy feet, afforded me opportunities of studying the nature of the strata. Sometimes the red, sometimes the white, variety occurs at the surface; and I have found the latter at a depth of seventy feet. Some of the varieties, when weathered, assume an ochre yellow colour.

A fine display of these varieties of the clay-slate occurs in the bed

of a ravine near Kulladghee. They there alternate with beds of greywacke. They have a very highly inclined, and, in some places, a vertical dip; and their direction is about north and by west, south and by east. In the dry season they can be very easily examined; for they are completely exposed for an extent of probably a quarter of a mile, except in a few spots where they are covered with debris. In those parts of the ravine where they have been worn down and polished by the stream, their red, blue, and white colours produce a beautiful appearance.

Chlorite-Slate.—This rock is very widely distributed throughout these districts. It is met with throughout the whole of the central and southern parts of the Darwar district, in the ghauts, and at several points on the western coast, under the claystone conglomerate. Its most common colour appears to be light greenish-grey. In the Ramghaut, I found it with disseminated grains of felspar, and having a fine slaty structure. There is a variety found near Darwar and Kittore, which is intermediate between chlorite-slate and clay-slate. It has a bluish-grey colour, a slightly greasy feel, is hard, and has a coarse slaty structure. When tolerably compact, it is employed as a building stone; for which it is well adapted.

Some varieties of the chlorite and clayslates contain crystals of iron-pyrites. I have been informed that this mineral is sometimes sent all the way to Madras, by the native merchants, as an article of trade, I believe for the purpose of being cut into beads and other ornaments used by the natives.

Talc-Slate.—This, like the chlorite slate, has a very wide distribution throughout these districts. There are several varieties of it. The talc sometimes occurs unmixed with any other substance. It has, in this case, a fine slaty structure, and a greyish or reddish colour. This variety I found a few miles from the falls of Garsipa. Most frequently the talc is mixed with quartz; and the rock has then the general appearance of mica-slate, excepting the difference in the characters of the two minerals. This variety occurs in the central parts of the Darwar district, and in the western ghauts. At Nurgoond and Chick Nurgoond, the strata of this variety have a nearly vertical dip; and their direction is south-east and by south.

Potstone is found associated with these rocks in the south-east part of the Darwar district; and is used by the natives for the manufacture of various utensils. The soapstone, which is sold in all the bazars, is probably also obtained from the same formation; but I myself have never seen either it or the potstone *in situ**.

* I am indebted to Walter Elliot, Esq. for the specimens of potstone which I have, and which he took directly from the quarries.

All the fine plaster with which the walls of the houses are covered in India, and which is so much admired by strangers, is composed of a mixture of fine lime and soapstone, rubbed down with water : when the plaster is nearly dry, it is rubbed over with a dry piece of soapstone, which gives it a polish very much resembling that of well polished marble.

Limestone.—I have met with limestone only in the north-east parts of the Darwar district. Numerous large beds of it occur about Kulladghee and Bagulkote, where it is associated with clayslates and greywacke. Its strata are highly inclined, and their general direction appears to be north and by west, south and by east. The principal colours of the limestone are yellowish grey and blue ; more rarely it approaches to white. Its fracture is generally flat conchoidal. One of the varieties, from near Bagulkote, answers well as a lithographic stone ; for which purpose it has been used at Bombay.

Greywacke.—This rock, as already stated, is associated with the clayslates and limestone at Kulladghee ; it also occurs in some other parts of these districts. Most of the coarse greywackes there have not the hardness that usually belongs to the same rock in Britain ; but, on the other hand, they partake of the loose aggregation of the clayslates with which they are associated. I have met with *greywacke slate* on the Mulperba and in the southern parts of the district.

Gneiss.—All the transition gneiss that I have met with in the Darwar district was weathered ; and, at first sight, therefore, it closely resembled a loose sandstone. It occurs in large quantities at Dummul ; and beds of it are also met with at Nurgoond associated with talc-slate.

Quartz Rock.—Beds of quartz are found among all the other transition rocks in these districts ; and, in some instances, they are very large. It also occurs in all of them in the form of veins.

In the whole of that tract of country, extending from Darwar to beyond Kittore, and which is characterized by its parallel ranges of hills, the quartz occurs in large beds, which are almost invariably found forming the summits of these ranges. This circumstance enables us to account for the hills being parallel to the strata of which they are composed ; and, consequently, to each other. The durable nature of the beds of quartz has caused them to resist the attacks of the weather, while the soft clayslates with which they are associated have gradually given way. The valleys have thus been scooped out between the parallel beds of quartz rock, which we find forming the summits of all the hills ; their flanks and the bottoms of the valleys consisting of the softer and more perishable clayslates.

The quartz of which these beds are composed, is in general deeply coloured with iron. Some varieties, however, have a grey colour, a splintery fracture, and closely resemble hornstone. It has often a uni-

form brown colour ; and some specimens contain so much iron, as to increase considerably their specific gravity. In many instances, the base of the rock is white or grey ; and is traversed in all directions by dark brown coloured veins highly impregnated with iron. But, in some specimens, the dark brown variety is in much larger quantity than the white basis ; and then the latter appears as if it had been broken into a number of small angular fragments, which had been afterwards united by the consolidation of the brown variety from the fluid form. This variety contains numerous small cavities, which are lined with red hæmatite in the shape of stalactites, or having a blistered or mammillary form. The cavities are generally very small ; but I have seen very large specimens of red hæmatite which were found in the Kupputgood Range. Brown hæmatite is also sometimes met with ; but it is not so common as the other.

I may here mention, that I found a large bed of a variety of compact magnetic iron-ore, on the summit of a small hill, near Hitnal,* a village in the Hyderabad country. It is associated with mica-slate, and quartz rock ; and the base of the hill consists of granite.

Old Red Sandstone.—This is one of the most extensive formations in India. It forms the summits of most of the eastern ghauts. It extends over a great part of the district of Cuddapah ; occupies extensive tracts in the Deccan ; forms the summits of most of the hills in the Vindhya and Gondwana ranges on both sides of the Nerbuddah ; and extends over part of Bundelcund, and even as far as Delhi.

The old red sandstone occupies a large tract of the districts, the geology of which forms the subject of this paper. From Gudjunderghur, where it rests immediately upon the granite, it extends north and north-east, as far as the Kistnah, occupying all the north-east corner of the Darwar district, and extending some way into the Hyderabad country. From thence it stretches across the country to beyond Gokauk, occupying all that tract which has been already pointed out in a former part of this paper. It also forms the summits of three insulated hills in the centre of the district, namely the hills of Noulgoond, Nurgoond, and Chick Nurgoond. On all of these three hills, it forms large tabular masses, the sides of which form mural escarpments all round ; and, from the bottom of these escarpments, the hills have a gradual slope to the plain below. At Noulgoond the sandstone rests on granite ; on the two latter hills it rests on the talc-slates of the transition class.

From Gudjunderghur to Badamy, and in all the hills south of the Mulperba, the strata of sandstone are almost universally horizontal. The hills are all very nearly of the same altitude, are in long ranges,

* Hitnal is about ten miles to the east of Copal.

having even summits, and, when seen from a distance, they look like huge natural walls.

North of the Mulperba, the strata of sandstone are in general more or less inclined; and they appear to rest there unconformably upon the transition rocks, namely the clay-slates, greywacke, limestone, &c.

In regard to its mineral composition and structure this rock varies exceedingly. It occurs under the forms of a coarse conglomerate, a coarse sandstone, and different varieties of compact quartz. Its most common colours are red and brown; and it is frequently variegated with white.

At Gudjunderghur, and in the hills which extend from that place to Badamy, it is in the form of a very coarse sandstone. It there consists, generally speaking, of grains of quartz, cemented together by means of clay. Sometimes the quartz is in large rounded or angular masses, thus forming a coarse conglomerate. Generally, however, it is in smaller grains of uniform size, forming a coarse sandstone. Its general colour is red. Sometimes it is variegated with white; the white being in patches, or in straight or waved lines; and I have seen large round nodules of white imbedded in the red base.

To the north of the Mulperba the quartz, or compact variety, prevails. It has a splintery fracture and brown colour. In many instances it is traversed in all directions by white veins. It is, in many places, associated with puddingstone, which occasionally forms very large beds. In the hills of Nurgoond and Chick Nurgoond, both the arenaceous and compact varieties are found very near each other. In one part of the latter hill, the compact variety has, on the large scale, somewhat of a spheroidal structure. In the south-east part of the Nurgoond Hill there is a large mass of a diaphanous quartz with a bluish colour, and disseminated grains of felspar. This variety is by no means uncommon, especially in the hills south of Kulladghee, where it has sometimes a reddish or white colour.

Some geologists might be disposed to arrange this sandstone with the old red sandstone of English geologists (transition red sandstone of the Germans); but I am inclined to consider it identical with the old or new red sandstones of the Wernerian geognosy; and, therefore, as very generally disposed in an unconformable position in regard to the transition rocks. I will now, therefore, state, as briefly as possible, the circumstances upon which I rest this opinion.

First, In many parts of the Darwar district the sandstone hills have horizontal strata, level summits, and, for many miles, exactly the same altitude; while at one part we find granite, at another part transition rocks, immediately at their bases.

Secondly, On the south-east declivity of the small hill of Chick Nurgoond, the schists are not covered by debris. Their dip is vertical,

and their direction nearly north-west by west. They can be traced to within a few feet of the sandstone, which forms the summit of the hill, and which dips towards the north-west, at an angle of about 40°.

Thirdly, A small range of sandstone, or rather quartz hills, near Kulladghee, is divided in several places by ravines. In walking up one of these ravines, you have the quartz hills on both sides, and can observe their strata inclined at a small angle, while the bed of the ravine along which you walk consists of the clayslates and greywackes, which are found in all the low parts of the adjoining country, and the strata of which are mostly vertical.

I have never seen the sandstone conformable to the transition rocks; but I do not mean to say that this may not sometimes be the case. The above observations however, are, I think, quite sufficient to shew that it is very often unconformable, and may belong to one or other, or include both the red sandstones of the Wernerian geognosy.

The following striking appearances are presented by the sandstone of Badamy. The hills at that place, composed to their very bases of sandstone, have perfectly even summits, and are surrounded on all sides by vertical precipices, descending, in many instances, completely to the valley, which is covered with fine sand, the debris of the adjoining hills. The sandstone strata are generally horizontal. The precipices have a height of probably two hundred feet* ; and the hills are, in many places, completely divided by rents from top to bottom, and are thus separated into a number of huge distinct masses. Some of these masses which are next to the plain, have a slight inclination forwards, and appear as if a very slight force would be sufficient to occasion their complete degradation.

The two small forts of Badamy are built upon these precipitous sandstone hills. Next the plain these forts are protected by a precipice of two hundred feet; and, on the opposite sides, they are defended by deep rents, which separate them from the adjoining parts of the hill. The only access to the forts is up through the rents already mentioned. Upon entering these at the bottom, you have on each side of you immense walls of rock, from one to two hundred feet high, and affording a passage of only a few feet in width. The rents are less deep as you advance; and the ascent is generally by means of steps cut in the solid rock.

A cave, the roof of which is supported by pillars, and the sides carved with representations of some of the Hindoo deities, is excavated in the sandstone of Badamy. It is not, however, to be compared, in point of size, with the caves of Elephanta or Ellora.

* I state this only *from memory*: it must therefore be considered merely as an approximation.

Secondary Trap Rocks.—Trap rocks occur very extensively in different parts of India. They are met with in some parts of Mysore and Hyderabad. They occupy a very large part of the Deccan, extend from near Fort Victoria on the western coast northword beyond Bombay, stretch thence across the country through Kandeish into Malwa ; and are also met with in Bundelcund and Marwar.*

In the Darwar district they do not occur in great abundance. The great formation of trap, which extends all the way from the northern parts of the Deccan to the south of the Kistnah, terminates here ; and the trap hills to the south and east of Belgaum probably form its boundary in that direction. It is therefore in the north-western part of this district that the trap is principally met with. I must also mention, however, that I found a compact greenstone at Sedasheghur resting upon granite ; but I am inclined to think that it does not belong to the secondary trap which we are now considering, but to a much older formation.

The trap in the neighbourhood of Belgaum forms rounded hills, and does not exhibit the appearance of steps of a stair, which characterizes the trap in other places. It is also found in the form of veins traversing granite, in some parts of the Hyderabad country. A very large vein of secondary greenstone is found traversing the granite at the village of Mussaputtan, near Anagoondy. It is so large as to form a small range of hills, which, being nearly bare, can be recognised at a great distance by their black colour.

The most common rocks which occur in this extensive formation are, a loose greenstone, basalt, and amygdaloid. The first, which appears to be the most common, has a concentric lamellar structure, the lamellæ separating very easily from each other, and becoming harder towards the centre, which contains a hard nucleus. Sometimes this variety has a rhomboidal structure ; but, in this case, each rhomboid is found to have the concentric lamellar structure in its interior. This greenstone is almost always weathered to a very great depth. It is, therefore, very difficult to get a fresh specimen. When weathered, it has a grey colour ; when fresh, it is found to be composed of distinct grains of felspar and hornblende.

The compact varieties of greenstone are very much employed in India as building stones. Most of the magnificent mosques and mauslea at Beejapore, which is situated in the midst of the trap formation, are built of it.

I found basalt at the village of Baugwarry, twelve or fifteen miles east from Belgaum. It contains small vesicular cavities, which appear never to have been filled with any substance.

* *Vide* Mr. Fraser's paper in the first volume of the Geological Society's Transactions, New Series.

I have never seen the amygdaloid *in situ*; and it does not appear to be common in the Darwar district. Specimens of it have been brought to me from the neighbourhood of Beejapore. They contain zeolites, green earth, and calcarious spar; and resemble the same rock in Britain.

Ferruginous Claystone.—This is the laterite of Buchanan. It covers very large tracts, both in India and the neighbouring countries. It extends all along the western coast, from Fort Victoria to the southern extremity of the peninsula.* It occurs in great abundance in the Deccan, in Mysore, in the district of Cuddapah, and in Orissa.† It is met with also in Ceylon; and is almost the only rock which occurs in Malacca‡.

This rock may be described, generally, as consisting of claystone, more or less impregnated with iron, and having a massive, perforated, or cellular structure. It frequently contains, imbedded in it, small masses of clay, quartz, or ironstone. In its native beds, a short way under the surface, it is so soft that it can be easily cut with a hatchet or spade; and, when sufficiently compact, and not containing imbedded portions of quartz, &c. it is cut into square masses like bricks, and is used as a building stone. Hence Buchanan gave it the name of laterite; and its names, in the native languages, are derived from the same circumstance. When these square masses are exposed to the air for some time, they become very hard; and, when not exposed to constant moisture, they answer admirably as building stones. Most of the handsome Roman Catholic churches at Goa are built of this claystone or laterite. In the principal fronts of these churches it is covered with plaster; but, in other parts, it is left bare, and completely retains its hardness when exposed to the atmosphere.

The ferruginous claystone occurs in different parts of the Darwar district; but principally in the western parts, and on the summits of the ghauts. Scarcely any other rock is seen in the Goa territory, and it extends almost uninterruptedly from Goa to Honoor. It is found resting in different situations, on granite, transition rocks, trap, and sandstone. It is a very curious and interesting circumstance in regard to the geognostical situation of this rock, that it is found resting upon granite and transition rocks along the coast, and is again found resting upon the same rocks at the summits of the ghauts, at an elevation of several thousand feet. It forms, along the coast, a succession of rounded hills; and, towards the sea, it generally presents mural precipices. I have never seen beds of any other rock alternating with it;

* *Vide* Mr. Calder's paper in the Asiatic Journal for October, 1828.

† *Vide* Asiatic Researches, vol. xv. p. 177.

‡ *Vide* Finlayson's Mission to Siam and Hue, p. 37.

and it is no where stratified. Sometimes it forms table-shaped masses on the summits of the ghauts; and, where it is split into separate masses on the coast, these have sometimes an obscure cuboidal form. It may be said, however, to have no distinct structure, and merely to form enormous overlying masses, which extend over a very large part of the peninsula of India.

In some places the claystone contains numerous small nodules of clay iron-stone, which seldom exceed the size of a walnut. These are picked up by the natives, and are smelted by means of charcoal in a very small rude furnace, blown by the hand-bellows, common all over India, and still used in Europe by the Gypsies. If any profit can be obtained from such a very rude and tedious process, to what good account might not the rich ores of hæmatite and magnetic iron be put?

Many of the hills composed of this rock are nearly devoid of vegetation; their surface being bare and smooth, and of a red or black colour. The soil produced by its disintegration is not very productive; and so liable is it, in some places, to consolidate, when deprived of its moisture, that, if it be not constantly cultivated, it soon becomes hard and bare, and checks all vegetation.*

I have seen no secondary rocks in India above the old red sandstone, except the trap and ferruginous claystone. Dr. Adams mentions, that he found rolled pieces of coal in the bed of the Towa river, which falls into the Nerbudda†; but he did not see the coal *in situ;* and the existence of the coal formation, therefore, in the peninsula of India, still forms an interesting subject of enquiry for future observers.

Cotton Ground.—Immense deposites of a black alluvial clay are met with in various parts of India. It is denominated cotton ground, from the circumstance of that plant being always cultivated upon it. It is the regur soil of the ryuts. It forms large plains throughout the whole of the Deccan; some of them sufficiently extensive to bring to mind the descriptions given by travellers of the Pampas of South America, or the Steppes of Russia.

Its depth extends from two or three to twenty or thirty feet. Its colour is greyish black or brownish black. In many places it is perfectly unmixed with any foreign ingredient. In other instances it contains nodules of calcarious tufa‡, agates, calcedony§, and occasionally

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* It is to this passage that reference is made at page 107 of the last number of this Journal, in the essay on the geological characters of the laterite.—R. C.

† *Vide* Memoirs of the Wernerian Society, vol. iv. p. 61.

‡ This substance is well known by the name of Kunker in India.

§ The same circumstance is noticed by Dr. Adams in regard to the black soil of the Nerbudda valley. Memoirs of the Wernerian Society, vol. iv. p. 52.

also zeolites. In the hot season, it is everywhere traversed by deep fissures; which, in some cases, have a great appearance of regularity, like that observed in dried starch; but most commonly they are perfectly irregular. The late Dr. Voysey, when at Hyderabad, subjected some of this clay or cotton ground to the heat of a steel furnace, which fused it into a black glass.

The black colour of this clay, the carbonate of lime, agates, and zeolites found in it, and its conversion into a black glass by heat, all indicate that it has originated from the disintegration of trap-rocks. The extensive distribution of the trap-rocks makes this inference still more conclusive. The soil which covers the trap-hills, and which we are certain has originated from the disintegration of the subjacent rock, exactly resembles the cotton ground of the extensive plains. Were this cotton ground to be again consolidated, it would form an immense overlying formation of a substance resembling basalt or wacke. Its very great importance in the agriculture of India will be considered hereafter.

Several deposites of calcarious tufa occur in the Darwar district. There is one of considerable extent near Badamy. It is covered by the soil, and appears to rest upon the transition rocks. Sometimes nodules of calcarious tufa are found disseminated through the cotton ground, and materially affect its agricultural properties. From its being thus associated with the cotton ground, I think it is highly probable that the calcarious tufa has, in many instances, owed its origin to the calcarious spar of the trap-rocks, of those rocks the debris of which now forms the cotton ground. The tufa is used for the preparation of mortar.

In concluding these observations, I have much pleasure in expressing my acknowledgment to Professor Jameson for having corrected some of my observations, and for his valuable remarks upon my specimens of the rocks of the Southern Mahratta country.

Agriculture, &c.—Were I to give any thing like a detailed account of the agriculture of the Darwar district, I would have to repeat much that has already been published in the works of Buchanan and Marshall; and, moreover, such details would possess little interest for the general reader. I will therefore merely present a slight sketch of the agricultural features of the district, with an account of the different articles of cultivation and their uses, and will particularly notice whatever circumstances have hitherto escaped the observation of others.

The peculiarities of climate in the different parts of this district, necessarily occasion a great diversity in their agricultural characters. The western parts, towards the ghauts, which are covered with forest, and have a very wet climate, admit of the cultivation of a little rice only in the valleys or on the gentle slopes of the hills. As we proceed

eastward, the climate becomes gradually drier, the forest diminishes, and the dry crops become more abundant. Lastly, towards the eastern parts of the district, we meet with nothing but dry crops, except in a few spots, where rice is cultivated by means of artificial irrigation. These circumstances give rise to a very natural division of the soils of the district into two distinct kinds, as has long been adopted by the natives, viz. those on which rice can be cultivated without irrigation from tanks, and those suited only for dry crops. The former are called Mulnad, the latter Belwul lands. The former are confined to the western parts of the district, it being there only that there is a sufficient supply of rain for the cultivation of rice, without artificial irrigation. The latter occupy all the middle, the eastern, and south-eastern parts. At the same time, it necessarily happens, that the mulnad and belwul lands are in many places intermixed, especially towards the eastern border of the hilly tract, where the valleys have still a sufficient natural supply of water for rice cultivation, and the adjoining high lands can be only cultivated with dry crops.

The belwul lands are further subdivided into several different kinds, two of which only require particular notice, namely the regur or yerree, and mussub or mussaree. The former is the black cotton ground already described ; the latter includes all those soils which have originated from the disintegration of the neighbouring hills. It therefore differs most materially in different situations, and is sometimes called red ground from its prevalent colour.

The cotton ground, or regur soil, forms one of the most curious features in the physical geography of this part of India. It has been already described in the geological part of this paper, where it was shewn that, in all probability, it has originated from the disintegration of trap-rocks.* It varies in depth from two or three to twenty or thirty feet, and even more, and is of prodigious extent, covering all the great plains in the Deccan and Kandeish, some of those in Hyderabad, and perhaps also in other parts of India. It is as remarkable for its fertility as for its very great extent ; and a very curious circumstance is, that it *is never allowed to lie fallow, and never receives the slightest manure.* Even the stems of the cotton plant are not allowed to remain on it, being employed for making baskets, or used as fire-wood ; and farther, in all those parts of the country where the cotton-ground is met with, there is so little wood, that the cow-dung is carefully collected (as already mentioned) and dried for fuel. Cotton, jooaree, wheat and other grains, are raised from it in succession ; and it has continued to afford most abundant crops, without receiving any return for centuries,

* I am indebted for the following report on the chemical nature of the cotton ground, to Mr. Reid, Lecturer on Chemistry, who was so kind as to examine a portion of it :—

" Fuses readily before the blowpipe into a dark black slag.

nay, perhaps, for two or three thousand years,—thus proving the inaccuracy of the opinion held by agriculturists, that if something be not constantly added to land equal to what is taken from it, it must gradually deteriorate. Attention must be paid to the order of cropping, as will be more particularly mentioned hereafter; but, with this precaution, the ryut is always sure of an abundant return, provided the weather be favourable.*

It is probable that the fertility of this soil is principally owing to its power of absorbing moisture from the atmosphere, which is great, even when compared with the best soils of Britain. Sir Humphry Davy says, "I have compared the absorbent powers of many soils with respect to atmospheric moisture, and I have always found it greatest in the most fertile soils; so that it affords one method of judging of the productiveness of land." He farther states, that one thousand parts of a celebrated soil from Ormiston in East Lothian, when dried to 212°, gained in an hour, by exposure to air saturated with moisture at a temperature of 62°, 18 grains; and that one thousand parts of a very fertile soil from the banks of the river Parret in Somersetshire, under the same circumstances, gained 16 grains.† The following are the results of some experiments I made on the absorbent power of the cotton soil. I thoroughly dried a portion of the soil, by exposing it for a long time to a heat that was nearly sufficient to char paper. I then exposed 2615.6 grains of this to the atmosphere of a moderately damp apartment, and found, after a few days, that it had gained 147.1 grains. I now exposed it to an atmosphere saturated with moisture, and found that it daily increased in weight till the end of a few weeks, when its weight was found to be 2828.4 grains. It had therefore gained 212.8 grains, or about 8 per cent.

In the hot season, the regur or cotton ground is traversed in all directions by very deep fissures. In the rainy season it is in the form of a very tenacious clay. Almost all the crops that are cultivated upon it are sown towards the end of the rainy season, and therefore receive, during their growth, comparatively little rain, and often, indeed, the

" In platina foil, it forms a lighter-coloured slag, having a greenish grey colour.

" Fused into a solid mass in a large covered crucible placed in a furnace; a crust of oxide of iron gathered on its surface.

" It consists of silica in a minute state of division, with portions of lime, alumina, and oxide of iron. The proportion of vegetable and animal debris appeared to be very small. Minute portions of the roots of vegetables were seen on close inspection with the naked eye."

* It will be an interesting subject of inquiry for future observers, to ascertain whether any organic remains occur in this extensive deposite, to throw light on its origin, which I think will not improbably be found to be diluvial.

† Elements of Agricultural Chemistry, p. 160.

only moisture which they receive for a length of time is that of the heavy dews.

The mussub, or mussaree soil, does not form extensive plains like the cotton ground; but is generally found at the foot of hills, or in the bottom of small valleys. At the bases of the sandstone hills, it consists of little else than loose sand. On the sides of the hills, that contain beds of quartz, it is very gravelly. The soil which covers the laterite, and which has originated from the disintegration of that rock, is, in general, not very productive, and is apt to become extremely hard in dry weather; but in the bottom of many of the small valleys in the western parts of the district, large deposites of it, which have been more perfectly disintegrated and mixed with other substances, are met with, and form productive soils. The soils in the valleys, between the clay-slate hills, are also in many places very good.

There are three different seasons of sowing in this part of India. The first is in the end of May and beginning of June, after a few of the first annual showers have fallen. The second is in the end of June or beginning of July, after the monsoon has fairly commenced. The third is in September and October, towards the end of the rainy season. During each of these periods, certain crops only are sown; and, therefore, in giving an account of the different articles of cultivation, I shall arrange them according to their seed times.

I. *Articles of cultivation*, which are sown in the end of May and beginning of June.* These are sown, when the ground has been moistened by the showers which fall in May, and are ready for reaping before the end of the rains.

1. *Sesamum orientale*, Lin.; *Tul*, Duk. *Gingilie Seed.*—Only a small quantity of this is cultivated in the Darwar district on inferior kinds of mussub land.

2. *Phaseolus max*, Lin.; *Orood* or *Oreed*, Duk. *Black Ulandoo.*

3. *Eleusine coracana*, Flor. Ind.; *Cynosurus coracanus*, Lin.; *Ragee*, Duk. *Nutchanee*, Eng.—This is extensively cultivated on the poorest mussub soils; and in many parts of the district it forms the principal part of the food of the lower classes.

4. *Panicum Italicum*, Lin.; *Rala* also *Kungonee*, Duk. *Italian Panicle.*—This is cultivated on secondary kinds of regur soil in various parts of the district, and forms a very common article of diet with the natives.

* In the following part of this paper, I will give the Dukhuny and English names, as well as the botanical names of the different articles of cultivation, trees, &c. I thought of adding their Malabar and Canarese names, but find that it would extend this paper to too great a length: and the Dukhuny names will generally be found sufficient for identifying the different articles in India. I have given no name that was not accurately determined by myself, by means of communications from intelligent natives.

5. *Panicum miliaceum*, Lin.; *Sawee*, Duk.—This is not cultivated very extensively, and is not much esteemed by the ryuts. It ripens sooner than most of the other articles in this class.

II. *Articles of cultivation which are sown in the end of June, or beginning of July.* These are sown when the first heavy rains are over, and are ready for reaping towards the end of December, or beginning of January.

1. *Andropogon Serghum*, Flor. Ind.; *Holcus Sorghum*, Lin.; *Joovaree*, Duk. *Red Juwary.*—This is very extensively cultivated in this district, principally on the mussub lands.

2. *Panicum Spicatum*, Flor. Ind.; *Holcus spicatus*, Lin.; *Bajera*, Duk.—This is extensively cultivated on the best kinds of mussub lands.

3. *Phaseolus aconitifolius*, Willd.; *Mut* or *Moat*, Duk.

4. *Phaseolus mungo*, Lin.; *Moong*, Duk. *Ulandoo.*—These two species of *Phaseolus* and the *P. max* already mentioned, are cultivated in most parts of the district, and both on the regur and mussub lands.

5. *Cytisus cajan*, Lin.; *Toour*, Duk. *Dale.*—This is always sown in rows among different kinds of grain. It is much esteemed as an article of food by the natives, and is also frequently used by Europeans in soup. There are two varieties of it, the large and small.

6. *Glycine tomentosa*, Lin.; *Kooltee*, Duk. *Madras gram.*—This is extensively cultivated on different kinds of soil throughout the district. It is principally used, (as in other parts of the Madras territories), as food for horses.

7. *Dolichos Lablab*, Lin.—It is not improbable that the different varieties of this plant, which are extensively cultivated over the peninsula of India, will hereafter be found to constitute several distinct species. I will notice two of these, which have come under my own observation, and which have hitherto been described by authors simply as varieties. The first is the *Saim kee pullee*, Duk. This is biennial or triennial; attains many feet in length; legumes racemed, long, scymitar-shaped. Requires irrigation during the dry season, and is cultivated in gardens. There are three varieties of this *species*, which are distinguished from each other by the colour of their flowers and seeds, namely, the white, red, and green. The green legumes and ripe seeds of all these varieties are favourite articles of food with the natives. The white variety is little inferior to French beans, and is sometimes eaten by Europeans. The second is the *Bullur*, Duk. This is annual, and much smaller than the former. Legumes broad, 4-seeded. It is cultivated all over the peninsula. The beans are generally used as food for cattle; but in many places they are also a favourite article of food with the natives*.

* Buchanan confounds together the above two plants. At the same time, he expresses a doubt whether the plant be the *D. Lablab* of Linnæus.

8. *Dolichos Catiang,* Lin.; *Suffaid Lobeh,* Duk.—The lobeh is called *Dolichos sinensis* by Marshall; but it certainly agrees much better with the characters of the *D. Catiang,* as given by Persoon. Its legumes are erect, linear, in pairs. It is usually cultivated on the mussub lands, in rows, among different kinds of grain.

9. *Dolichos Tranquebaricus,* Lin.; *Hureea Lobeh?* Duk.—This is cultivated, but not very extensively, on the mussub lands.

10. *Linum. usitatissimum,* Lin.; *Ulsee,* Duk.; *Common Flax.*—This is cultivated on regur soil, in most parts of the district, on account of its oil. The natives appear to be unacquainted with the mode of preparing flax; for which purpose, indeed, the plant which I have seen growing in this district, would be ill adapted, being much weaker and shorter than in Europe.

11. *Crotolaria juncea,* Lin.; *Sun,* Duk. *Indian hemp.*—This is cultivated in small quantities, in most parts of the district, for the purpose of making cordage and the sackcloth called gong.

12. *Hibiscus cannabinus,* Lin.; *Umbaree,* Duk.—This is generally cultivated on good mussub, and sometimes on the regur soil. Its stalks afford material for cordage, and sackcloth; and an oil is expressed from its seeds, which is used as an article of food, and also for burning in lamps.

13. *Oryza sativa,* Lin.; *Chawul,* Duk. *Rice.*—Rice is principally cultivated in the mulnad lands, that is in the valleys in the western parts of the district, where the heavy rains, and a constant supply of water from the neighbouring hills, afford facilities for the inundation of the fields. It is also cultivated in a few spots in the central and eastern parts of the district, where a sufficiency of water can be obtained from the large tanks. The best mode of culture is reckoned that by transplantation*. In this case the seed is first sown very thick in a small piece of ground, about the commencement of the rains. When the plants are half grown, they are transplanted into the fields, previously covered with water, where they are placed in rows. This practice, however, is very frequently abandoned, except by the most industrious, on account of the great labour it requires. The grain is therefore often sown at once on the ground on which it is to come to maturity. Another method is to make the seed vegetate by means of its being covered for several days with water and cow-dung, before sowing it. These three different methods of cultivation are also followed in other parts of India†. The advantage of the first method is, that it affords time for a crop of different kinds of pulse to be taken from the ground before the rice is planted.

* *Vide* Marshall's Statistical Report.

† *Vide* Buchanan's Journey through Mysore, Canara, &c. Vol. I. p. 84.

14. *Ervum lens*, Lin.; *Mussoor*, Duk.—This is cultivated only in small quantity, and principally in the western part of the district.

III. *Articles of cultivation, which are sown towards the end of the rains in September and October.*—These are ready for reaping at the end of four or five months. Except at the commencement of this season, the moisture which these crops receive is principally derived from the dews, which are deposited in considerable abundance during these months.

1. *Andropogon Sorghum* (variety), Flor. Ind.; *Holcus Sorghum*, Lin.; *White Juwary*. "It differs," says Marshall, "from the red jooaree in the case of the seed being white, which in the other is brownish; in the stalk not growing to half the height, and containing much more of the saccharine principle." It is cultivated on the regur soil.

2. *Cicer arietinum*, Lin.; *Chinna*, Duk. *Bengal Gram*, or *Chick Pea*.—This is cultivated on good regur land all over the district, except in the most westerly parts. It is generally employed as food for horses. In many places, also, the natives use it as a common article of diet. An acid exudes from all parts of the plant, and is often collected in the following manner by the ryuts. The dew which is deposited on the plant over-night, is found in the morning to be strongly impregnated with the acid. Long pieces of cloth are then dragged over the plants until they become quite wet with the acid liquor, which is then wrung out; and this process is renewed until the whole field has been gone over in the same manner. The liquor is of a brown colour, is slightly acid, contains a large quantity of saccharine matter, which gives it a sweet taste, and when allowed to evaporate very slowly, the acid is deposited in cubical crystals. It is sometimes used by the natives in their curries, instead of vinegar; and is also employed by the native doctors in medicine.

3. *Gossypium herbaceum*, Lin.; *Kupas*, Duk. *Cotton*.—India has been celebrated from the earliest times for her fine fabrics of cotton; and although now excelled in the manufacture of cotton-cloths by western nations, the raw material still continues to be one of her most important productions. But even in the quality of the raw material, she has of late years been excelled in several other countries; and it therefore becomes an object of the first importance that the best methods of cultivating and preparing the cotton should be ascertained. These considerations will serve, I hope, as an apology for the length of the following observations on the cotton of the Darwar district.

The cotton in this, as well as in other parts of the Deccan, is only cultivated on the regur land; and I am not aware whether it is ever cultivated on other kinds of land, in other parts of India. There is

very little produced in Mysore, Malabar, and the other parts of the peninsula, which are to the south of this district; and in the few places where it is met with in these countries, it is found to be of an inferior quality.* Is this owing to the absence of the regur or cotton ground in these parts? I am indebted for the following account of the mode of cultivating cotton in the Darwar district to J. R. Stevenson, Esq. sub-collector in the Southern Mahratta country:

"The black regur land on which cotton is sown *is never manured;* but cotton crops are only raised from it once in three years. If raised two years in succession, the crop of the second year is always bad. In the two intervening seasons juwary† is generally cultivated, and the crops of juwary produced the year after the cotton are very abundant; so much so, that the ryuts have a long story of a farmer, who, when he felt himself dying, only regretted that he was not spared to reap the crops of the year succeeding the cotton season; and he bitterly upbraided fate for its injustice in depriving him of what he had been looking forward to for three years.

"The cotton seed is sown with a drill plough, in drills about ten or twelve inches asunder, in the end of August, or beginning of September, or as soon after the middle of August as the land is sufficiently saturated to receive the seed.‡ In about eight days the plant makes its appearance; and when it is nearly five or six inches high (about November), the weeding commences. The weeding implement is called Yedee. It is a double hoe, the blades being about three or four inches apart; is drawn by bullocks, and guided by a handle projecting backwards. The blades of the hoe, which turn rather inwards, cut out the weeds, and at the same time throw earth on the roots of the plants. This process of weeding is henceforward repeated once in eight or ten days, or oftener, if required. The cotton should be ready for gathering in the beginning of January. The first gathering is not considered good. The second and third are the most plentiful; and the harvest continues so long as the plants continue to bear, which they generally cease to do in the end of March. The labourers employed in gathering are paid in kind. They receive a fourth of the first picking, a sixth or an eighth of the second and third, and a fourth or a fifth of the remaining. When the period of ploughing arrives, the stems are picked up, and are used as fire-wood, or for making baskets, &c.

"When the cotton is brought to the cultivator's house, it is spread out in the sun, and thrashed with rods to cleanse it of the husks. It is

* *Vide* Buchanan's Journey through Mysore, &c.

† *Andropogon Sorghum*, Flor. Ind.

‡ The time of sowing necessarily differs in different parts of the district, for the rains are later as we proceed eastward.

then separated from the seed, either by the gin*, or by a small iron-roller, which a woman moves with her toes on a smooth stone. The latter is on the same principle as the gin, only she feeds it with her hands, and works the iron-roller with her feet. The seed is kept for the cultivator's cattle, or paid, in lieu of money, to the labourers employed in the separation of the seed. The cotton undergoes no more cleaning whilst in the hands of the ryut, but is sent to the market in this state.

" The Bourbon cotton is not cultivated in this district." The ryuts say " that a bush of this cotton takes up too much space,—that it would not be so profitable as the common cotton—that, in March and April, when the regur land yawns, the roots would be exposed, and the plants would consequently die—that it would require water in the hot season," &c. &c. Notwithstanding these objections of the ryuts to the cultivation of the Bourbon cotton, I have no doubt, that, in many parts of the district, it would answer well, and prove valuable. The above objections apply only to the regur-land, and to the eastern parts of the district. In all that part of the country which is west of the meridian of Darwar, the plants would receive a sufficient supply of moisture without irrigation; and, if planted on good mussub soil, they would not be liable to be injured by the yawning of the ground in the hot season, for this takes place only in the regur soil. The plant is perennial, and therefore would not require to be renewed like the common cotton; and although it does not bear fruit till the third year, yet other articles can be cultivated between the rows of the cotton-plants during the two or three first years, while they are still small. I may only add, that several plants of the Bourbon cotton thrived remarkably well in red gravelly soil in my own garden at Darwar, without receiving any water, and where the climate is not nearly so moist as that of the country farther to the west. The quality of the Bourbon cotton is very superior to that of the common cotton of the district.

The common cotton of the Darwar district is of good quality, but is seldom well cleaned. Were a little pains taken to have it well cleaned, it would prove a very profitable article. A *candy* of 500lb. of clean cotton can generally be bought at Darwar for 62 rupees. Sack-cloth and packing would cost ten rupees; and carriage to Sedasheghur, the nearest seaport, would cost ten rupees more, making altogether 82 rupees for 500 lbs. If we call the rupee one shilling and ten pence, therefore, this cotton could be put on board ship at Sedasheghur, at the

* This consists of two small wooden rollers, through between which the cotton is drawn, and the seeds are thus left behind. It appears to be similar to the gin used in the West Indies, except that it is turned by the hand.

rate of little more than $3\frac{1}{2}d.$ per pound.* At present a good deal of this cotton is carried to Bombay by Parsee merchants, by way of Comptah, a place much further down the coast than Sedasheghur, and therefore occasioning a much longer land as well as sea-carriage, than were the cotton carried to the latter place. The only reason that I could discover for these merchants preferring Comptah to Sedasheghur, was, that the former place is nearer to the pepper country than the latter, and is therefore more convenient for that branch of trade. The latter possesses the great advantage of being situated at the mouth of a fine river, which is navigable for large boats, as high up as fifteen or sixteen miles; whereas Comptah is situated on a paltry stream at some distance from the sea, and cannot be approached closely, even by the small coasting vessels. Some cotton is also exported from this district to Mysore.

4. *Ricinus communis*, Lin.; *Erind.* Duk. *Castor-oil Plant.*—There are two varieties of this plant, the large and small seeded. The former is principally cultivated in this district. It produces an inferior kind of oil, which is mostly employed for burning in lamps. It is cultivated on the regur soil.

5. *Carthamus tinctorius*, Willd.; *Koosum*, Duk. *Safflower.*—This is cultivated in most parts of the district on good regur soil, only on account of the oil which is expressed from its seeds. In many parts of India it is cultivated merely on account of the fine red dye prepared from its flowers, which are here allowed to wither.

6. *Nicotiana Tabacum*, Lin.; *Tumbak*, Duk. *Tobacco*.—Is cultivated on the regur soil in several parts of this district; but is not considered to be of good quality. The crop is often very much injured by a parasitical plant, the *Orobanche Indica* (Roxb. Hort. Bengal.), which grows from the roots of the tobacco plants, and prevents their growth. These parasites sometimes grow as high as the tobacco plants themselves, and if they get into a field, the crop is sure to be much injured, if not ruined.

7. *Triticum æstivum*, Lin.; *Gioon*, Duk. *Wheat.*—There is a good deal of wheat cultivated in this district on the regur soil. It is chiefly exported to the western coast, and to various parts of the country.

8. *Indigofera Anil*, Lin.; *Neel*, Duk. *Indigo.*—It is curious that, although a large quantity of indigo be used in this district, and although the plant be indigenous, not the smallest quantity of dye, until within the last two or three years, was ever prepared by the inhabitants; the consumption being entirely supplied from the Ceded Districts, and other parts of India. Its cultivation having been encourag-

* At present no duties are levied on goods exported from Sedasheghur.

ed by the Collector of the district, it has been found to thrive, and is likely to become an important article of cultivation.

Garden Productions.—Different kinds of gardens are cultivated by the natives, such as kitchen gardens, fruit gardens, or orchards, cocoa-nut gardens, betle-nut gardens, &c.; but it is only the first that we intend to consider at present. They are inclosed with a fence of milk hedge *(Euphorbia Tirucalei*, Lin.), or prickly pear *(Cactus ficus Indica)*, and are irrigated either from wells or tanks. The soil is prepared by digging, and is well manured. I must remark, however, that some of the following articles are also occasionally raised in the open rice fields; and a few are also cultivated by the more industrious in small plots of ground close to their cottages.

1. *Dolichos fabæformis*, Lin.; *Mut ke*, Duk.—This is a favourite legume with the natives.

2. *Zea Mays*, Lin.; *Muk jooaree*, Duk. *Indian Corn.*—This is seldom allowed to ripen, but is used as a vegetable when green.

3. *Hibiscus esculentus*, Lin.; *Baindee*, Duk. *Bandaky*, Engl.—This vegetable is much used, both by the natives and Europeans; and is considered very wholesome and nutritious.

4. *Saccharum officinarum*, Lin.; *Shukkur*, Duk. *Sugar Cane.*—Is cultivated both in gardens and in rice-fields; and, in the latter case, two crops of rice are always taken between each crop of cane.* The land is prepared for the sugar-cane by repeated ploughing and a large quantity of manure; and the cuttings are planted in the end of January or beginning of February. The cane is ripe in eleven or twelve months after the time of planting. The sugar cane of this district is either sold in the bazars to be eaten raw, or is used for making jagory, which is merely the inspissated juice of the cane. Sugar of tolerably good quality is made at Kolapore.

5. *Convolvulus batatas*, Lin.; *Shakkur Kundoo*, Duk. *Sweet Potato.*

6. *Daucus Carota*, Lin.; *Gajoor*, Duk. *Carrot.*—The carrot is very extensively cultivated in this district, and attains such perfection, that the carrot seed of the Southern Mahratta country is in great request in other parts of India.

7. *Allium Cepa*, Lin.; *Peeaz*, Duk. *Onion.*

8. *Allium sativum*, Lin.; *Lussum*, Duk. *Garlic.*

9. *Solanum Melongena*, Lin.; *Byngun*, Duk. *Brinjal* or Egg Plant.

10. *Capsicum frutescens*, Lin.; *Lal mirchee*, Duk. *Chilly.*—The chilly is very extensively cultivated in fields as well as in gardens, and is much used by the natives as a condiment. The ryut often makes a mixture of chillies, turmeric, and other vegetable substances, which he takes with him to the field, and eats, spread on a juwarry cake. Mar-

* *Vide* Marshall's Statistical Report.

shall calls this plant the *Capsicum annuum* in his Statistical Report, which is evidently a mistake.

11. *Capsicum grossum*, Lin.; *Kaffray mirchee*, Duk. *Caffry Chilly.* —This is only cultivated, in small quantity, in the gardens of Europeans at Darwar and Belgaum.

12. *Raphanus sativus*, Lin.; *Moollee*, Duk. *Radish.*

13. *Momordica charantia*, Lin.; *Karaila*, Duk.

14. *Cucumis acutangulus*, Lin.; *Toraee*, Duk. *Acute angled Cucumber.*—This vegetable is eaten by the natives, both raw and dressed in various ways, but is not esteemed by Europeans.*

15. *Cucumis sativus*, Lin.; *Kunkuraee*, Duk. *Cucumber.*—This is cultivated in small quantity in the gardens of Europeans. Some other cucumbers are also cultivated by the natives, but in less quantity than the last species.

16. *Cucumis Melo*, Lin.; *Khurbooza*, Duk. *Melon.*—Is cultivated in small quantity in some parts of this district, generally in sandy soil, on the banks of streams.

17. *Cucurbita lagenaria*, Lin.; *Hurea Kuddoo*, Duk. *White Pumpkin.*

18. *Cucurbita Citrullus*, Lin.; *Turbooza*, Duk. *Water Melon.*—This is very generally cultivated throughout the district.

19. *Trichosanthes anguina*, Lin.; *Chikonda*, Duk. *Snake Gourd.*

20. *Trigonella Fœnum Græcum*, Lin.; *Maitee*, Duk. *Fenugreek.*

21. *Coriandrum sativum*, Lin.; *Dhunnia*, Duk. *Coriander.*—This is cultivated in fields sometimes as well as in gardens.

22. *Rumex vesicarius*, Lin.; *Chukka*, Duk. *Country Sorrel.*

23. *Piper Betel*, Lin.; *Pawn*, Duk. *Betel-leaf Vine.*—The cultivation of the betel is almost entirely confined to the western and southern parts of the district; and even there, betel-gardens are not numerous. In Soonda there are some gardens of the betel-nut palm (*Areca catechu*, Lin.), in which the betel-leaf vine is also cultivated.

24. *Arachis hypogœa*, Lin.; *Velaetee moong*, Duk. *Manilla gram.*

25. *Amaranthus polygamus*, Lin.; *Choulaee* and *Rajgheery kee bajee*, Duk.—Is used as greens by the natives.

26. *Amomum Zinziber*, Lin.; *Zinziber officinale*, Flor. Ind.; *Udruk*, Duk. *Ginger.*—Is cultivated in small quantity in various parts of the district.

The following are the principal fruit trees met with in the Darwar district:

* A diarrhœa, which prevails to a great extent, in certain seasons, among the native inhabitants at Darwar, I am inclined to attribute to the large quantity of raw cucumbers they eat.

1. *Musa sapientum* and *M. paradisiaca*, Flor. Ind.; *Mouz.* Duk. *Banana* and *Plantain.*—Roxburgh considers the banana and plantain to be varieties of the same species; the original of which is found in the forests of Chittagong.* I have been assured that wild plantains are found in the western forests in the Darwar district, but I have not myself seen them.

2. *Tamarindus indica*, Lin.; *Umlee*, Duk. *Tamarind.*—The tamarind is not very abundant in the eastern parts of the district; but, towards the west, it is met with both cultivated and wild.

3. *Mangifera indica*, Lin.; *Awm.* Duk. *Mango.*—The mango is found, in the wild state, in the western jungles, and is cultivated in various parts of the Darwar district. It flowers in January and February; fruit ripe in May and June. The mangoes of this part of India are seldom so good as those of Goa and Bombay; but a variety, cultivated in the garden of the nuwab of Savanoor, exceeds in size and in beauty any mango I have ever seen. Some of these Savanoor mangoes that were sent to me, measured two feet in circumference.

4. *Artocarpus integrifolia*, Lin.; *Fannus*, Duk. *Jack.*—This fruit is not abundant in the Darwar district.

5. *Anacardium occidentale*, Lin.; *Kajoo*, Duk. *Cashoo-nut Tree.*—I have only seen this at Kittoor; but it probably occurs in gardens in other parts of the district.

6. *Spondias mangifera*, Lin.; *Junglee awm*, Duk. *Wild Mango.*

7. *Eugenia jambos*, Lin.; *Jamb* and *Ghoolabee-jamb*, Duk.—*Rose Apple.*

8. *Psidium pyriferum*, Lin.; *Jam*, Duk. *Guava.*—This fruit is to be met with in almost every village in the district.

9. *Citrus medica*, Lin.; two varieties; *Turanj* and *Neemboo*, Duk. *Citron* and *Lime.*

10. *Citrus aurantium*, Lin.; *Naringhœ*, Duk. *Orange.*—A small, sweet, pleasant-tasted orange grows in the gardens at Misrecottah. It is not common in other parts of the district.

11. *Citrus decumana*, Lin.; *Chukotta*, Duk. *Pumplemose* or *Shaddock.*

12. *Vitis vinifera*, Lin.; *Ungoor*, Duk. *Grape Vine.*—Excellent grapes are cultivated at Belgaum, Darwar, Dummul, Gokauk, and some other places. There are two varieties, one large, red, and fleshy; the other small and green.

13. *Annona reticulata*, Lin.; *Ram phul*, Duk. *Bullock's Heart.*—This is cultivated in some native gardens.

14. *Annona tripetala*, Lin.; *Seeto-phul*, Duk. *Custard Apple.*—This delicious fruit thrives well in most parts of the district. It flowers at Darwar, in March and April. I am not aware whether it occurs in

* *Vide* Flora Indica, vol. ii.

the wild state in the western jungles; but it grows in such great abundance in the granitic soil of the Hyderabad country, as to have sometimes afforded food to the inhabitants, in times of scarcity, in very dry seasons.

15. *Ficus carica*, Lin.; *Unjoor*, Duk. Fig.—Excellent figs grow in various parts of this district.

16. *Ziziphus jujuba*, Lin.; *Bair*, Duk.—This is found in great abundance in the Darwar jungles, and the fruit is sold in the bazars. The Dukhuny name of the fruit has been adopted by the English in India.

On the Soil suitable for Cotton, Tobacco, Sugar, and the Tea plant. *By* H. Piddington.*

[Read at the meeting of the Agricultural Society of India, March 1836.]

I preface what I have to say to the Society on the soils placed on the table with a few remarks, which I trust may be thought worth placing on record. My object in doing so is again to impress upon members of what vital importance it is to the advancement of the agricultural interests of the country, and to the safety and success of every agricultural speculation, to procure samples of all soils from other countries in which valuable products grow.

The same climate and soil are, we know, in a greater or less degree the essential requisites for obtaining the production of one country in another; and for our present purpose we may perhaps say that plants *find* their food in the soil, and are enabled to *digest* it by the climate. They *do* digest, we know, and this in the strictest sense of the word.

The popular ideas of climates are vague enough, but it may be roundly asserted, that scarcely one who uses the word knows what is really meant by soil; or rather what is really meant by " the *same* soil." This arises from our vague notion of the thing itself. The very words used to distinguish soils express, more frequently than any thing else, their appearance, and some of their physical qualities; scarcely any their essential—that is their chemical properties. We talk of light and heavy, of sandy and clayey, moist and dry soils, which are all physical properties, and two clayey or two sandy soils may be actually as different as light and darkness from each other! The words ferruginous and calcarious are, it is true, chemical terms, but such vague ones that

* In a letter written by Dr. Wight, subsequent to the printing of his last paper on the Flora of Courtallum, he expresses a regret that he was unacquainted with Mr. Piddington's valuable analysis of soils, when that article was composed. At Dr. Wight's suggestion we re-publish the above, and it comes very appropriately as a sequel to Dr. Christie's paper.—*Editor Madras Journal.*

they designate whole *classes* of soils, of which each sort is widely different from its neighbours. The tea soils and the Arracan tobacco soils on the table are both ferruginous soils, but differing as widely as soils can do ; for the iron in the one is a carbonate of iron, and in the other the red oxide of iron.

Cotton.—Nothing then but a sample of the soil and a correct analysis of it can assure the speculator, that while he is trying to rear any given foreign product, he is not (misled by loose names) absolutely blundering in darkness, and attempting an impossibility. I begin with Cotton as a most prominent example, though my proofs on the subject are not quite so full as I could wish ; and I shall surprise the Society not a little when I say, that all the expensive efforts which have been made hitherto to obtain good cotton have probably failed from this one cause, *that we have been at work on the wrong soil* ! How far, with the American cottons, differences of climate may also have operated is not here the place to examine, but vegetable productions do, to a great extent, acclimate themselves ; while it is probable that nothing can compensate to them the want of a principal constituent of the soil. Now I have not been able to obtain specimens of the American cotton soils, but I have good authority for stating that the soil of the Sea Islands is wholly a calcarious sand—in other words a light chalky or shelly soil ; so that it may probably contain from 50 to 60 per cent. of calcarious matter (lime generally in the state of chalk), and we have been attempting to grow this cotton on a soil which barely contains a trace of it ! The soil of the Botanic garden, for instance, not containing more than 1½ or 2 per cent. : Indeed we may say generally, that till we reach the *kankur* districts, none of the soils of lower Bengal, out of the reach of the inundations, contain any great portion of lime. I showed some years ago*, that the inundations deposit lime, and that much of the fertilizing effect they produce is due to it.

The American cotton is, then, on account of differences of climate, a case not strictly in point, but the Bourbon cotton—grown both at Bourbon and the Mauritius—which sells for a shilling, when the Sea Island sells for 13*d.* and the Manilla cotton, which sells for 11*d.* when the Bourbon is worth a shilling, are both cottons of hot climates like our own ; and both these are grown in highly calcarious soils. The soil on the table before you is from the Mauritius ; it is sent me by M. Geneve, of La Riviere Noire, one of the finest estates on the island, as an excellent cotton soil, and contains 32 per cent. of carbonate of lime, (or in plain English, one-third chalk) ; there is, moreover, phosphate and perhaps not less than 40 per cent. of calcarious matter ! Its iron too is in a peculiar state, that of protoxide or the black oxide of iron ;

* Trans. of the Phys. Class, As. Soc. Vol. I.

and in this respect, it probably resembles the black cotton soils of Southern India. No wonder that the Bourbon cotton, though it grows well in many of our gardens near town, where it meets with plenty of calcarious matter amongst the lime-rubbish with which most of them are filled, is said to degenerate when cultivated in the open fields, which do not contain 2 per cent of lime. I know, from the experience of several years, that it does *not* degenerate if it is duly supplied with calcarious matter; but that it will produce most abundantly, and for years, cotton worth from 10*d.* to 11*d.* per lb. in a proper soil. If the soil does not suit it, it will produce little else than leaves and wood, and the staple will deteriorate. Samples of American cotton soils are wanting now to make our theory on this head perfect; but I would advise no man to attempt foreign cottons in a soil containing less than 15 per cent. of lime, and its iron mostly in the state of protoxide or black oxide.

Tobacco.—Tobacco soils are the next, and here we are more fortunate, for there are on the table soils from Arracan (Sandoway); a soil from Singour in Burdwan, near Chandernagore, the tobacco of which, though of the same species as that of the surrounding country, sells at the price of the Arracan sort! and the soil of the best Bengal tobacco, which is grown at and about Hinglee, in the Kishnagar district, near factories formerly held by me. Colonel Hazeta and Dr. Casanova are our authorities for saying, that the tobacco soils of the Havanna are *red* soils, and those of Manilla, I know, are also *red* soil. Now the red and reddish brown soils contain most of their iron in the state of peroxide, or the reddish brown oxide of iron; while the light-grey soils contain it only in the state of protoxide, or the black oxide of iron. I believe the quality of the tobacco to depend mainly on the state and quantity of the iron in the soil; while it is indifferent about the lime, which we have seen is so essential to cotton. None of these tobacco soils contain any lime. Their analysis shows them to contain:—

	Arracan soil.	*Singour soil.*	*Hinglee soil.*
Oxide of iron (peroxide)......	15.65	10.60	6.00*
Water and saline matter......	1.00	0.75	1.50
Vegetable matter and fibres....	3.75	1.10	.75
Silex........................	76.90	80.65	87.25
Alumina....................	2.00	4.50	1.50
	99.40	97.69	97.00
Water and Loss....	.60	2.40	3.00
	100.0	100.00	100.0

* Mostly protoxide.

—from which it will be seen that the best tobacco soil we have hitherto found in India contains 16 per cent., or nearly one-sixth, of iron, which is mostly in the state of peroxide, and that the inferior sort of tobacco grows in a soil containing only 6 per cent., one-sixteenth of iron of which is moreover mostly in the state of protoxide or black oxide.

I thought it worth examining what the quantity of iron in the different sorts of tobacco would be ; and I found that, while the ashes of one ounce, or 480 grains, of Havanna and Sandoway cheroots gave exactly 1.91 grains or 0.40 per cent. of peroxide of iron, the ashes of the same quantity of the Hinglee or best Bengal tobacco only gave 1.50 grains or 0.32 per cent., and it appears to exist in the first two in the state of peroxide, and in the last, as a protoxide, of iron ; rendering it highly probable that the flavour of the tobacco to the smoker depends on the state and quantity of the iron it contains ! for we have now, observe, traced the iron from the soil into the cheroot. Green copperas water, which is a solution of sulphate of iron, is often used by the American and English tobacconists and planters to colour and flavour their tobacco ; and this would be decomposed by the potass of the tobacco, and sulphate of potass and carbonate of iron be formed. Carbonate of iron is of an ochre yellow colour. I took care to ascertain that this process had not been performed with the cheroots used for my experiment ; and I do not believe our Bengal cheroot-makers know of this method.

Sugar.—Sugar seems to depend both on the state of the iron and on lime in the soil. The sugar soil before you is also from the Black River, (Mr. Geneve's), an estate upon which from 3000 to 7000, and even on one spot the astonishing quantity of 12,000 lbs. of sugar have been obtained from an acre, of from 12 to 150 bazar maunds per bigah ! Captain Sleeman is my authority for these statements.

Now the peculiarity of this soil is, you will observe, that it is a *red* soil, *i. e.* that its iron is mostly in the state of peroxide ; and it contains moreover about 9 per cent. of carbonate of lime, with probably some sulphate and phosphate of lime, say perhaps altogether 10 or 12 per cent. of calcarious matter. We have in many instances endeavoured to cultivate this cane on soils destitute both of peroxide of iron and lime, and we complain that the cane has been found watery. It is clear that the cultivator who would succeed in sugar should pay attention to these peculiarities ; for without doing so he may have *returns*, but often no profits. His profits, in a word, may depend upon his canes, his cotton, or his tobacco, being *fed* with the food which they require. I used the words *feed* and *digest* because it cannot be too often repeated that plants are living beings, and that the vigour of their life depends, as with ourselves, on abundant and suitable food.

Tea Soils.—The tea soils, though I notice them last, are not the least interesting. The first is a soil from Assam, for which I am in-

debted to Captain Jenkins ; and the second is from the Bohea Hills in China, sent round by Mr. Gordon, the Secretary to the Tea Committee, and obligingly given to me by Mr. Grant, of the Honourable Company's Export Warehouse. How very alike they seem, you will at once have noticed, and their analysis gives as follows :—

	Tea soils of Assam.		*Tea soil of China.*
	Surface soil.	At $2\frac{1}{2}$ feet deep.	
Water	2.45	2.00	3.00
Vegetable matter	1.00	.80	1.00
Carbonate of Iron	7.40	6.70	9.90
Alumina	3.50	5.45	9.10
Silex	85.40	84.10	76.00
	99.75	99.05	99.00
Traces of phosphate and sulphate of lime and loss,	.25	.95	1.00
	100.0	100.00	10.000

There are two peculiarities in these soils ; the first, that they contain no carbonate of lime, and only traces of phosphate and sulphate ; and the next, that their iron is almost wholly in the state of carbonate of iron—a widely different compound from the simple oxides. They would be called poor yellow loams ; and cotton, tobacco, or sugar-cane would probably starve upon them : but we find that they suit the tea plant perfectly. It is a striking coincidence, that we should find our tea soils and those of China so exactly alike.

I fear to grow prolix, though I have much more to say on the subject of soils ; I shall therefore break off, trusting that for the present I have amply shown the necessity of a careful examination of the soil ; and that the commercial public, who can do so much for us in this way, will not neglect their own interests in procuring specimens of soils for us ; for to go to work in ignorance of this great element of success, is absolutely to blunder on in the dark where chemistry would lend us an unfailing light.

[We have also received specimens of the tea soils for analysis, but for want of space must postpone the notice of our results, which agree for the most part with Mr. Piddington's. We have also an analysis of the Assam tea soil by Dr. McClelland.—Ed.]

Transactions of the Linnean Society of London. Vol. xvii. part 2d, 1835.

[About two-thirds of this volume consists of a paper entitled, " *A Commentary on the fourth part of the Hortus Malabaricus. By (the late)* Francis Hamilton, m. d. We extract the following remarks from the *Records of General Science*, a publication, established in London last year and edited by Dr. Robert Thomson, which may justly claim a first rank in the scientific periodical literature of the day.—*Editor Madras Journal.*]

The object of the commentary is to remove the discordancies in the nomenclature of Indian botany, particularly with regard to the adaptation of the native to the scientific names. The difficulties attending such an attempt are very numerous and complicated ; because the native names are often indiscriminately applied to various species, when the latter approach each other in character or quality ; and, in the East, where the vegetable kingdom is ransacked in all departments for the purpose of supplying a materia medica to the native physicians, these obstacles become more multifarious and perplexing than in more civilized parts of the earth, where, however, it may be alleged that the physical properties of plants are undervalued. Dr. Hamilton is inclined to consider the native names properly applied as exhibited in the following columns, which we have drawn up for the benefit of our friends in India, where our Journal is already perused :

Manga domestica	Mango Mao, or Mau
Catappa sylvestris	Ada maram
Myristica Malabarica	Panem palka
Barringtonia racemosa	Samstravadi
Stravadium acutangulum	Tsjeria Samstravadi
Holigarna longifolia	Katou Tsjerou
Terminalia, or Myrobalanus } Taria	Tani
Rumphia tiliœfolia	Tsjem Tani
Limonia monophylla ?	Mal naregam
Randia virosa	Catu naregam
Limonia acidissima	Tsjerou Catou naregam
Vateria Indica.	Paenoe, Paenu
Lansium ?	Nyalel
Alangium decapetalum	Angolam, or Alangi
Hamiltonia ?	Idou Moulli
Sapindus emarginatus	Poerinsii
Duabanga Sonneratoides	Duyabanga Adamboe ?
Lagerstroemia hirsuta	Catou Adamboe
Eleocarpus perincara	Perin Cara

Mimusops hexandra ?	Manil Cara
Alangium tomentosum	Dhela
Theka ternifolia	Theka
Webera corymbosa	Katou Theka
Clerodendrum serratum	Tsjerou Theka
Cynometra ramiflora	Iripa
Rhus Odina	Kalesjam
Garuga pinnata	Catu Calesjam
Schinus Saheria ?	Ben Calesjam
,, Niara	Niyar
Papyrius, or / Broussonetia } integrifolia	Ponga
Vitex leucoxylon	Karil
Cordia ?	Vidi maram
Calophyllum inophyllum ?	Ponna
,, Calaba ?	Tsjerou ponna
Celtis orientalis	Mallam Toddali
,, Amboiensis	Tilayi
,, Acata	Acata
Zizyphus Mauritiana	Perim Toddali
Melastoma aspera	Kadali
,, Malabathrica ?	Katou Kadali
Avicennia Oepata	Oepata
Guettarda ?	Rava Pou
Samyda Canziala	Kanjiala Anavinga
,, piscicida	Konijal
,, glabra	Lohajang
?	Corondi
Sapium Indicum	Bengiri, Hurmayi
Melia integerrima	Ana Bepou
Camunium Bengeleuse	Bepu
Bergera integerrima	Ban Kongeha
Olea dioica	Kari Vetti
Agyneja multilocularis	Pee Vetti
Physalis Sugunda	Sugunda
Antidesma Zeylanica	Noeli Tali
,, paniculata	Amri
Callicarpa ?	Poutaletsje
Azalea ?	Modagam
Scaevola taccada	Taccada
,, lobelia / ,, Modagam }	Bella ?
Sterculia guttata / ,, Balanghas }	Ramena Pua or Pou Maram ?

According to Hamilton, the *Vateria Indica* produces the gum *anime* which Dr. Roxburgh says is termed in commerce, East Indian Copal. Schindler tells us that there are three kinds of Copal: 1. The East Indian, or African Copal, is the brightest and softest, and affords the best varnish. It is sometimes called *ball copal.* 2. The second variety is called West Indian or American Copal, being derived from the Antilles, Mexico, and North America, and is procured, according to Martius and Hayne, from different species of *Hymenea, Trachylobium*, and *Vouapa.* It is termed *stone copal,* and is yellower than the preceding kind. It comes to us in hard, flat pieces, weighing about three ounces. It is less easily melted than the preceding variety, and seldom contains insects. 3. The third variety is also termed West Indian copal, but might be mistaken for the first species, as it occurs in the form of convexo-concave pieces, eight ounces in weight. Taste aromatic. Melting point between that of the two preceding. Fresh oil of rosemary dissolves the first in any proportion. Fresh oil of turpentine dissolves the first variety completely, but only dissolves a small portion of the other two, after long digestion. The action of alcohol is similar. Schindler terms the last species, for the sake of distinction, *insect copal.*

These facts I consider it proper to bring forward, because Dr. Hamilton denies that copal comes from India. Now, this opinion is at variance with the statement of Retzius, who called it *Elaeocarpus copalliferus,* because it afforded the gum copal. Dr. Roxburgh alleges also that the resin of the *Paenoe* is called East India copal. Mr. Turnbull of Mirzapour informed Dr. Hamilton that some which he sent home for trial would not sell for copal, although it was allowed to be *anime.* "The real copal and anime," he adds, "are American productions." The resin of the *Paenoe,* or *Dupa* (Vatena Indica) was probably used by the Brahmans of Malabar as an incense. The *Paenoe* is one of the finest ornamental trees in India; and in the province of Canara it is usually planted in rows by the sides of highways, making remarkably fine avenues. The statement of Mr. Turnbull is not conclusive, because he does not state that its rejection was the consequence of chemical examination.—*Records of General Science, for October,* 1835.

Chemical Analysis of Tabasheer. *By* THOMAS THOMSON, M. D., F. R. S., L. and E., &c., *Regius Professor of Chemistry in the University of Glasgow.*

Having lately received, from Calcutta, a very fine specimen of *tabasheer*, I was naturally induced to make a few experiments on its chemical constitution.

It is sufficiently known that tabasheer is a concretion met with occasionally in the joints of the bamboo; that it has been long employed in medicine, in Hindostan and the East; that it is very much esteemed; and, that it sells at a considerable price. The first good description of it was drawn up by Dr. Russel, and published in the "*Philosophical Transactions,*" for 1790, p. 273. The specimen, laid before the Royal Society, by Dr. Russel, was put into the hands of Mr. Smithson for chemical examination. A very minute, accurate, and complete set of experiments, by this acute and accomplished philosopher, was published in the "*Philosophical Transactions,*" for 1791, p. 368, from which it appeared, that the tabasheer was composed of silica nearly in a state of purity.

In the year 1806, a specimen of tabasheer, from Peru, was put into the hands of Fourcroy and Vauquelin, by Humboldt and Bonpland. These chemists subjected it to analysis, extracted from it 70 per cent. of silica, together with a little lime, and concluded (though it is not easy to see the evidence), that the tabasheer, which they examined, was a compound of 70 parts of silica, and 30 parts of potash. But under the potash were included the vegetable matter which they showed it to contain, and also, the water, the amount of which, they seem not to have thought of determining.

In 1819, a curious paper on the optical properties of tabasheer, was published in the "*Philosophical Transactions,*" by Dr. Brewster. An abstract of this paper, together with several particulars, relative to the history and formation of the tabasheer, was inserted in the eighth volume, of Dr. Brewster's "*Journal of Science;*" and in the same volume, we have a chemical examination of the tabasheer, by Dr. Turner. This analysis agrees very nearly with that of Mr. Smithson, and renders the accuracy of the statement of the great quantity of potash, announced by Fourcroy and Vauquelin, rather doubtful.

1. The tabasheer which I examined, was a very beautiful looking substance, in small irregular fragments of a blueish white colour and pearly lustre, not unlike chalcedony in appearance, but much softer. For it was incapable of scratching calcarious spar, and only slightly scratched sulphate of lime. When put into water, it gives out a great deal of air with a kind of crackling noise, and imbibes a great deal of water.

I found its specific gravity, (taken without allowing time for the internal air to escape), 1·9238. But, when by means of heat all the air bubbles had been driven off, the specific gravity was as high as 2·0824.

2. When ignited, it lost 4·87 per cent. of its weight. This loss consisted chiefly of water; but not entirely, for the tabasheer exhaled a peculiar odour, and, showed evidently, the existence of a small quantity of vegetable matter in it.

3. Ten grains of tabasheer reduced to a fine powder were digested in distilled water for 24 hours. The water when concentrated was tasteless; but slightly reddened vegetable blues. Being evaporated to dryness, grayish scales remained, weighing 0·6 gr. These scales being digested in muriatic acid, a little iron was dissolved, but the scales consisted almost entirely of silica. Thus, it appears, that the silica in the tabasheer is still soluble in water. I am disposed to consider, the reddening of vegetable blues in this case, as produced by the dissolved silica; at least, I did not succeed in finding any trace of any other acid substance. When the muriatic acid dissolved upon the scales was evaporated to dryness, a brown matter remained, which besides iron, contained also a trace of vegetable matter; but too small to admit of examination. It contained also a little lime and a little silica.

4. Ten grains of tabasheer reduced to a fine powder, were mixed with 24 grains of finely pounded fluor spar, and the whole was made into a thin magma by means of sulphuric acid. This mixture was exposed for some hours to the heat of the sand bath in a platinum crucible. After the exhalations of fluosilicic acid had ceased, the crucible was exposed to a heat gradually increased to redness, and kept in that temperature till all the excess of sulphuric acid had been driven off. The white matter in the crucible (chiefly of lime) was now lixiviated with water, till every thing soluble was taken up. The water thus employed, was mixed with some carbonate of ammonia, and filtered to separate the lime which it had dissolved in the state of sulphate. The water, thus nearly freed from lime, was reduced to a small quantity, by evaporation, and, while still hot, was mixed with a few drops of solution of oxalate of ammonia, to throw down a little lime which had either escaped the action of the carbonate of ammonia, or had been afterwards supplied by the filter. The mixture was allowed to stand till it became clear, the liquid was then drawn off with a sucker, evaporated to dryness, and the saline residue exposed to a red heat. A salt remained, which weighed 0·2 grains, and which proved, on examination, to be sulphate of potash, equivalent to 0·11 grain potash.

5. Ten grains of tabasheer in the state of a fine powder were intimately mixed with 20 grains of anhydrous carbonate of soda, and the mixture exposed in a platinum crucible to a red heat, raised at last sufficiently high to bring the whole into a state fusion. The colour of the fused mass was yellowish brown. It was dissolved in muriatic acid the solution evaporated to dryness, and the residue, after being digested a sufficient time in muriatic acid, was thrown on the filter. The silica edulcorated, dried and ignited weighed 9 grains.

6. The muriatic acid, in which the silica had been digested being

concentrated, was mixed with caustic ammonia. Yellow flocks fell, which were separated by decantation: these flocks, when ignited, became dark brown, and weighed 0·1 grain; they dissolved readily in muriatic acid. The solution was super-saturated with caustic potash, and digested on the sandbath for 24 hours. By this means 0·01 grain of alumina was dissolved. The rest consisted of peroxide of iron. Thus, the yellow flocks thrown down by caustic ammonia, consisted of

Peroxide of iron,............	0·09
Alumina,....................	0·01
	0·1

The liquid from which this precipitate had fallen was not rendered muddy by carbonate of ammonia. It was, therefore, evaporated to dryness. A greyish matter remained weighing 0·08 grain. This matter being digested in muriatic acid, there remained undissolved 0·05 grain of silica. The 0·03 grain dissolved, consisted of a mixture of alumina and lime.

Thus, the constituents obtained were,

Moisture,..................	0·487	or	4·87
Silica,.....................	9·050	„	90·50
Potash,.....................	0·110	„	1·10
Peroxide of iron,...........	0·090	„	0·90
Alumina,...................	0·040	„	0·40
	9·777		97·77

The loss, amounting to 2·23 per cent., was probably the consequence of my employing different portions of the tabasheer in different steps of the analysis. For they were not all exactly the same in appearance. Hence, possibly the proportion of the constituents might vary somewhat in each. But my supply of tabasheer was not sufficiently great to admit of a new analysis upon a large scale. I did not weigh the lime; but do not think it could exceed 0·1 per cent. It is needless to observe, that the preceding analysis accords sufficiently with the experiments of Mr. Smithson and Dr. Turner, and, therefore, serves to confirm them. The tabasheer examined by Smithson, Turner, and myself was from India; that subjected to examination by Fourcroy and Vauquelin was from South America. It remains to be seen whether the constitution of the American tabasheer be essentially distinct from the Indian, as would appear from the 30 per cent. of alkali, &c. found in it by Fourcroy and Vauquelin.—*Records of General Science, for February,* 1836.

[Mr. Taylor, of the Madras Observatory, has kindly sent us the *Annuaire du Bureau des Longitudes* for the year 1836, thinking that the remarks of M. Arago on the Comet of Halley might prove interesting to our readers, as a supplement to his own observations to be found at p. 165 of our last number; the appearances of the comet in India and in Europe, having presented great discordancies. It will be noted that the singular *luminous sectors,* seen by the observers in Europe, were not remarked here; nor is there any mention made by M. Arago of the very remarkable "*conical shadow*" witnessed by Mr. Taylor. We find the observations of M. Arago translated, and conveniently abridged, in the *Records of General Science,* of which we therefore avail ourselves.—*Editor Madras Journal.*]

"*Halley's Comet.*—This remarkable visitor was first seen in the beautiful sky of Italy, on the 5th August last, at the Observatory of Rome, by Dumouchel and Vico. Its position then, was near ζ of the Bull. On the 21st of the same month, it was observed at Paris, Breslaw and Naples; on the 22d at Vienna and Berlin; 23d at London; 24th at Nimes; 26th at Dublin; 27th at Florence and Bologna; 31st at Yale College, Newhaven, in North America, by Professor Olmsted and Tutor Loomis, its right ascension, being by observation, 5*h.* 50·5*m.*, and its declination N. 24° 46′·8; on the 1st September at Turin and Geneva. By a letter, dated Madras, 27th September, which I have received, it appears*, that "no trace of the mysterious body can be found."† It was seen by the naked eye at Paris on the 23d Sept. and at Geneva on the 24th. On the 15th October, with the naked eye, the tail of the comet embraced an extent of 20°, but on the 16th, it appeared to extend only 10° or 12°. On the 30th, it was very distinctly visible to the naked eye all over Europe and America. This was 47 days before it reached its perihelion, which happened on the 16th of November. The previous calculation of Damoiseau gave the 4th of November for this event, that of Pontecoulant the 7th of the same month. But a more complete calculation of the action of the earth, and, especially, the substitution for the mass of Jupiter of the fraction $\frac{1}{1054}$, instead of $\frac{1}{1070}$, rendered it necessary to add 6 days to the previous determination, which brought the number to the 13th, within 3 days of the actual date. When Pontecoulant thus deduced the 13th as the date of the perihelion, he proceeded on the calculation, that 1054 globes similar to

* This is a mistake, as will be seen by reference to our last number p. 165. It was first seen on the 30th August, but, owing to the intervention of cloudy weather, no glimpse could be caught again until the night of the 19th of September. On the following night the Editor saw it through the telescope at the Madras Observatory.—*Editor Madras Journal.*

† It was visible in the Bombay presidency on the 6th October.—Edit. Records.

Jupiter would be necessary to form a weight equal to that of the sun. The recent observations of Airy have shewn, that it should be 1049, which raises the date of the perihelion from the 13th to the 16th; the difference between calculation and observation being only half a day for 76 years. This remarkable coincidence has raised some doubt. The perturbations produced by the planets upon which the French astronomers made their calculations, were as follow: augmentation of revolution by the action of Jupiter 135,34; diminution by Saturn 51,53; by Uranus 6,07; by the earth 11,70 = 66,04 total augmentation. Rosenberg, a German astronomer, considers that the action of Venus, Mercury, and Mars, may produce an acceleration of 6⅓ days, viz. 5⅓ days by the action of Venus, and one day by the combined attractions of Mars and Mercury. Pontecoulant asserts, that the action of Venus compensates itself, and that Mars and Mercury cannot produce any such powerful effect as that stated by Rosenberg.

It is natural to inquire, have any new phenomena been observed, or has any additional information been acquired by the visit of the comet of last year?

1. At the Observatory at Paris, on the 15th October, at 7 o'clock in the evening, by means of a lunar telescope, a sector comprised between two right lines directed towards the centre of the nucleus, was observed a little to the south of the point, diametrically opposite to the tail. The light of this sector greatly surpassed that of all the rest of the nebula. On the 16th, this sector had disappeared, but to the north of the point, diametrically opposite to the axis of the tail, a new sector was observed. On the 17th it remained, but was less bright. On the 21st, at ¾-past 6, P. M., three luminous sectors were distinctly seen in the nebula; the feeblest was situated at the prolongation of the tail. On the 23d, the sectors had disappeared. Schwabe, of Dessau, calls these sectors secondary tails. Mr. Cooper, observed one such sector in Ireland, on the 19th October; and Amici noticed the same at Florence on the 13th.

2. It cannot be said that the last appearance of the comet has added any thing to our knowledge of the nature of space. Supposing it to have passed through a resisting medium, it should have arrived at his perihelion sooner than if it moved through a vacuum. Now, on the contrary, according to Rosenberg, it should have been six days later over the results of calculation, apart from all idea of an ether. The difference though much smaller, found by Pontecoulant, is in the same direction.

3. No comets have presented hitherto any phases, so that we were ignorant of the nature of the light of these bodies. It was expected that the intensity would have been determined during the last appearance of Halley's comet, but the remarkable changes which it under-

went prevented this from being effected. M. Arago, therefore, adopted another method. On the 23d October, having applied an apparatus adapted for observation, he saw two images, which presented complementary tints, one red, the other green. By making a half revolution of the telescope upon itself, the red image became green, and *vice versa.* " Thus the light of the star, was not completely, at least, composed of rays endued with the properties of direct light, peculiar or assimilated; it contained some light reflected specularly or polarized, that is to say, definitely, some light proceeding from the sun."

Note.

The author of the *Memoir on the Geology of the Neelgherry* and *Koondah Mountains,* having written the article while on the Hills, could not consult the vol. (13th) of the Edinburgh Philosophical Journal, in which Dr. Daubeny's sketch of the geology of Sicily was published; and therefore was unable to transcribe the Professor's passage regarding the cavities of large dimensions in the limestone of Monte Pellegrino, near Palermo. Having since returned to Madras, the following paragraphs, illustrative of the subject in question are added here: " Before I quit the subject of the Palermo limestone, I must not omit a circumstance relative to the rock of Monte Pellegrino, near that city, which seems to deserve notice. Notwithstanding the uniform compactness, of this stone, wherever it has been recently quarried, we find it in these parts, which have been exposed to the weather, honey-combed in an extraordinary degree, *by holes of considerable size,* which penetrate several inches below the surface, but indicate from the gradual decrease of their dimensions, that the cavities were formed by the action *of the weather, sinking gradually into the substance of the stone.*

" These cavities in their size and appearances, reminded me of those, which occur near the surface of a hard silicious limestone belonging to the oolite formation in Gloucestershire, which has obtained the local name of the ' Dagham limestone.' "

The reader will easily see from the above quotation, that what Dr. Daubeny says about *the cavities having been formed by the action of the weather, sinking gradually into the substance of the stone,* is analogous to the *lodging of a drop of water* spoken of by Dr. Macculloch, and that it is similarly inefficient as a cause of these large corrosions in the limestone, as that of Dr. Macculloch for those in the granite.—P. M. B.

METEOROLOGICAL JOURNAL FOR THE MONTH OF JULY, 1836.

Days.	Barometer at Sun rise.	Barometer at 10 A. M.	Barometer at Noon.	Barometer at 2 P. M.	Barometer at Sun set.	Barometer at 8 P. M.	Barometer at 10 P. M.	Thermometer at Sun rise.	Thermometer at 10 A. M.	Thermometer at Noon.	Thermometer at 2 P. M.	Thermometer at Sun set.	Thermometer at 8 P. M.	Thermometer at 10 P. M.	Dep. of wet bulb Therm. Sun rise.	Dep. of wet bulb Therm. Noon.	Dep. of wet bulb Therm. Sun set.	Rain. Sun rise.	Rain. Sun set.	Evaporation.	Direction of Wind. Morning.	Direction of Wind. Noon.	Direction of Wind. Evening.	Remarks. Morning.	Remarks. Noon.	Remarks. Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	°	°	°	°	°	°	°	°	°	°	Inch	Inch	Inch						
July 1	29,876	29,914	29,883	29,854	29,833	29,870	—	76,1	88,3	94,0	95,0	89,0	87,2	—	7,8	18,8	9,2				NW.	NW.	SE by E	Cloudy	Th. Haze	Cloudy
2	,894	,928	,906	,878	,846	,848	—	72,9	87,3	91,3	94,0	87,1	85,3	—	2,9	15,2	7,6	0.559			S.	NW.	S.	Cloudy	F. C.	F. C.
3	,925	—	,935	,890	,874	,888	29,906	72,2	—	83,7	89,0	84,9	83,9	82,6	1,7	10,7	6,9	1,180			SW.	NW.	SW.	Cloudy	do	Cloudy
4	,896	,944	,912	,858	,863	,833	—	74,9	85,2	90,7	90,5	85,8	83,0	—	4,8	15,5	7,5				SW.	NW.	SE.	do	do	F. C.
5	,895	,930	,898	,850	,850	,850	—	72,8	85,8	90,0	92,8	85,2	84,2	—	4,2	15,8	6,4	0,104			W by W.	W.	S.	do	Cloudy	Cloudy
6	,885	,910	,880	,840	,832	,850	—	74,0	86,3	92,0	93,9	87,0	85,2	—	6,8	18,7	7,8			3,017	SW.	NW.	S.	do	do	do
7	,862	,896	,858	,838	,834	,853	—	78,0	87,1	91,8	93,0	86,0	85,2	—	11,1	17,5	8,0		0,174		W.	W.	SE.	do	Th. Haze	do
8	,862	,904	,875	,850	,834	,848	—	75,5	84,3	87,1	89,0	85,0	84,3	—	8,2	12,9	8,4		0,024		W.	W.	SE.	do	Cloudy	do
9	,870	,902	,876	,855	,836	,838	,858	75,0	85,7	89,3	90,0	85,7	83,3	84,0	9,4	15,3	8,7				W.	W.	SE.	do	Th. Haze	do
10	,880	,910	,890	,837	,832	,840	,850	74,0	86,0	88,1	92,0	87,2	84,9	85,1	8,4	13,3	8,9	0,042			W.	NW.	S.	Th. Haze	F. C.	do
11	,860	,898	,870	,848	,824	,834	—	78,1	89,0	92,1	94,4	84,7	83,9	—	11,1	17,4	7,7		0,458		W.	NW.	S by E	F. C.	do	do
12	,856	,885	,872	,840	,826	,832	,865	81,8	85,1	88,7	90,4	89,1	86,8	86,3	7,5	12,7	10,9				W.	W.	S.	Cloudy	Th. Haze	Haze
13	,878	,906	,890	,842	,828	,850	—	82,0	88,2	91,0	92,1	87,9	85,9	—	10,5	15,6	9,0			3,292	W.	SW.	SE.	Haze	Haze	Cloudy
14	,876	,912	,870	,852	,826	,840	,870	80,9	88,5	91,5	89,8	87,0	85,0	84,8	5,9	16,5	8,5	0,069			SW.	W.	S by E	Clear	Th. Haze	Haze
15	,884	,912	,906	,876	,870	,884	,928	79,7	87,8	89,0	88,7	85,8	84,9	84,6	5,0	10,2	7,3				SW.	SE.	S.	Haze	F. C.	do
16	,932	,952	,932	,902	,865	,895	,928	82,9	85,5	90,6	88,0	85,0	84,8	84,6	5,8	14,6	7,9				W.	NW.	S.	Cloudy	Hazy	do
17	,934	—	,928	,828	,890	,910	,950	84,0	—	88,8	83,4	85,8	83,5	84,4	5,0	8,8	7,4				SW.	SE.	SE.	do	F. C.	F. C.
18	,928	,950	,936	,905	,876	,838	,924	81,0	85,8	83,0	83,6	85,9	84,9	84,6	5,2	10,1	8,0				W.	SE.	SE.	do	Th. Haze	Clear
19	,830	,906	,890	,862	,850	,850	,880	79,5	83,7	88,8	88,7	86,5	85,0	84,6	5,9	11,4	7,2				W.	E.	SE.	Clear	F. C.	do
20	,852	,880	,858	,832	,818	,832	—	80,8	83,8	91,8	88,8	85,3	85,8	—	5,2	17,3	6,5			2,674	W. by S.	NE.	SE.	do	do	Cloudy
21	,855	,856	,854	,838	,830	,832	—	77,9	82,3	85,6	87,8	85,7	84,3	—	5,3	9,6	8,4	0,069			SW.	NW.	SE.	Cloudy	Cloudy	Haze
22	,860	,902	,902	,876	,850	,876	,900	78,2	81,9	83,2	84,5	82,4	82,1	81,2	3,5	5,4	4,2	0,149			SW.	NW.	S.	do	do	do
23	,852	,932	,910	,830	,852	,888	—	80,3	83,1	87,5	87,2	84,3	83,9	—	3,5	11,2	5,2				SW.	NW.	SE.	do	Th. Haze	do
24	,908	,936	,920	,880	,854	,858	—	74,3	81,2	84,0	84,1	83,0	82,3	—	4,1	5,9	4.7	0,903	0,028		SW.	W.	SE.	do	Cloudy	do
25	,885	,912	,892	,858	,825	,838	—	74,4	77,9	79,4	80,8	81,7	80,6	—	1,8	3,0	4,0	0,819			SW.	NW.	SW.	do	do	Cloudy
26	,868	,888	,878	,850	,822	,836	,855	76,3	86,2	83,3	84,0	83,0	81,5	80,3	2,1	5,6	4,8	0,312	0,069		NW. by W.	NW.	S.	do	do	do
27	,850	,876	,856	,830	,828	,838	,870	78,0	82,2	83,2	85,4	83,9	83,0	82,1	4,0	4,7	5,2			1,795	SW.	SE.	S.	do	F. C.	do
28	,868	,886	,870	,850	,816	,844	,855	78,0	82,3	84,0	85,4	83,8	82,8	83,0	3,4	5,7	5,2	0,142			S.	NW.	S.	Haze	Cloudy	Haze
29	,852	,898	,890	,845	,832	,840	,860	78,5	85,3	84,8	85,6	84,8	84,0	83,5	3,2	6,4	5,5				SW.	SE.	S.	do	do	do
30	,866	,918	,914	,852	,838	,858	,878	77,8	84,4	86,0	86,8	84,1	83,0	83,6	3,9	6,5	6,4				NW.	E.	NE.	do	do	Cloudy
31	,844	—	,852	,830	,788	,800	—	79,5	—	84,0	82,4	83,6	81,8	—	3,0	7,6	5,6				SE.	NW.	NE.	Th. Haze	do	Clear
Mean	29,879	29,910	29,891	29,857	29,841	29,857	29,888	77,7	85,4	88,0	88,8	85,6	84,3	83,7	5,5	11,6	7,1	—	—	—						

METEOROLOGICAL JOURNAL FOR THE MONTH OF AUGUST, 1836.

Days.	Barometer at							Thermometer at							Dep. of wet bulb Therm.			Rain.		Evaporation.	Direction of Wind.			Remarks.		
	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set	8 P. M.	10 P. M.	Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Sun rise.	Noon.	Sun set.	Sun rise	Sun set.		Morning.	Noon.	Evening.	Morning.	Noon.	Evening.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	0	0	0	0	0	0	0	0	0	0	In.	In.	In.						
Aug. 1	29,808	29,808	29,816	29,800	29,798	29,814	—	76,3	84,5	88,5	84,2	81,4	81,0	—	2,4	10,7	2,6		0,705		NW.	N.	W.	Haze	F.Clouds	Cloudy
2	,832	,862	,842	,810	,788	,818	—	76,3	82,1	85,6	85,8	84,0	81,8	—	3,8	8,2	0,2		0,003		SW.	NW.	E.	Cloudy	Th. haze	do
3	,840	,850	,842	,822	,808	,828	—	78,3	80,3	83,0	82,7	82,0	82,0	—	2,5	6,0	3,7		0,174	1,660	S.	W.	SE.byS.	do	Cloudy	do
4	,820	,850	,844	,814	,820	,860	—	74,5	81,5	83,3	85,0	80,1	80,0	—	2,8	6,0	1,3	1,958	0,035		S.	W.	SE.	do	do	do
5	,832	,882	,855	,820	,826	,850	—	75,5	81,5	83,0	83,2	82,1	81,8	—	3,0	5,8	4,0	0,646			SW.	SW.byW.	SW.	do	do	do
6	,856	,902	,870	,830	,828	,840	—	80,1	81,7	83,7	84,8	84,4	83,0	—	5,6	7,7	3,0				W.	W.	SW.	do	do	do
7	,854	—	,846	,826	,830	,862	—	80,4	—	82,6	84,6	82,9	80,8	—	4,3	6,0	4,9				W.	NW.	SW.	do	do	do
8	,860	,890	,868	,840	,844	,862	—	78,8	81,7	83,8	84,0	82,9	81,7	—	0,5	—	7,4				W.	NW.	W.	do	do	do
9	,836	,850	,832	,802	,788	,806	—	77,8	80,6	84,6	84,8	80,7	80,2	—	4,8	11,4	4,9		0,010		W.	W.	W.	do	do	do
10	,836	,862	,860	,838	,820	,850	—	76,4	82,0	84,8	86,0	83,3	83,0	—	4,2	11,2	4,3			1,990	S.	W.	SW.	do	do	do
11	,882	,920	,882	,852	,810	,838	—	77,2	82,6	85,0	86,0	85,0	84,3	—	5,2	9,2	9,0	0,062			SW.	WNW.	SW.	Clear	Th. haze	do
12	,866	,900	,876	,830	,818	,828	—	80,0	83,0	85,3	85,8	84,1	83,8	—	5,5	8,6	6,1				SW.	W.	SW.	Cloudy	Cloudy	do
13	,850	,882	,876	,836	,807	,817	—	75,2	81,5	84,0	85,4	82,0	81,8	—	3,7	6,7	5,5	1,146			S.	SW.byW.	SW.	do	do	do
14	,846	,888	,836	,808	,846	,824	—	76,3	83,6	85,0	85,6	83,8	82,8	—	4,1	7,0	5,1	0,003			SW.	NW.	S.	do	F. Clouds	do
15	,870	,910	,882	,838	,718	,828	29,862	75,2	81,8	84,0	86,0	84,3	83,8	82,3	3,2	8,2	5,0	0,642			W.	W.	S.	do	Th. haze	do
16	,858	,888	,862	,818	,898	,810	—	79,2	82,2	85,7	87,8	86,3	84,4	—	6,0	9,6	8,4				W.	NW.	SE.	do	do	Haze
17	,824	,890	,886	,816	,822	,852	,892	76.9	83,0	85,5	86,8	84,1	83,7	82,8	4,0	10,5	5,8	0,045		2,330	W.	NW.	S.	do	do	do
18	,904	,954	,942	,882	,854	,896	,916	80,5	82,1	85,0	86,7	85,6	84,0	85,0	2,5	9,8	6,7				W.	NW.	S.	do	F. Clouds	Clear
19	,904	,922	,882	,836	,804	,822	,842	79,8	84,6	87,5	90,0	85,5	84,7	84,8	4,5	10,8	5,7				SW.	NW.	S.	Haze	Clear	Haze
20	,832	,872	—	,850	,785	,798	—	80,9	84,0	—	85,8	85,0	84,3	—	4,6	—	5,5				SW.	NW.	SW.	Cloudy	Cloudy	Cloudy
21	,834	—	,846	,794	,788	,800	,812	81,1	—	86,6	87,9	85,3	84,0	84,4	7,8	8,5	10,0				SW.	NW.	SW.	Th. haze	Th. haze	do
22	,850	,890	,844	,786	,783	,804	,854	80,3	85,4	88,0	90,2	86,3	85,4	84,5	7,4	9,1	9,6				SW.	WNW.	S.	Cloudy	Clear	do
23	,848	,880	,870	,806	,790	,832	,864	76,0	83,0	85,3	86,5	85,9	83,8	82,0	4,4	6,6	6,2	1,413			W.	W.	S.	do	Th. haze	do
24	,862	,890	,860	,816	,788	,832	—	75,7	82,3	83,9	84,7	83,7	80,0	—	2,6	5,9	4,3	0,007		2,635	W.	W.	WSW.	do	Cloudy	do
25	,848	,882	,850	,832	,788	,814	—	78,0	82,3	84,9	86,4	84,0	83,5	—	2,8	7,8	5,9	0,066			SW.	SW. by W.	S.	do	Haze	Haze
26	,844	,896	,862	,832	,805	,856	—	80,6	83,6	85,6	85,7	84,8	84,1	—	4,5	9,7	6,1				W.	W.	S.	do	Cloudy	do
27	,932	,982	,950	,850	,888	,938	—	81,0	85,6	87,3	89,0	84,9	84,1	—	5,2	10,7	5,8				SW.	SW.	S.bySE.	Clear	Clear	Clear
28	,952	—	,970	,908	,882	,906	—	77,4	—	83,5	85,5	85,0	83,4	—	3,5	5,5	5,2	1,222			W.	SW.	SE.	Cloudy	F. C.	Haze
29	,920	,950	,932	,882	,870	,914	—	79,9	80,0	81,6	83,0	82,9	82,0	—	2,4	3,7	3,7	0,486	0,163		SW.	W.	S. by SE.	do	Cloudy	Cloudy
30	,883	,950	,928	,880	,832	,924	—	79,9	80,8	82,7	83,9	82,9	81,9	—	4,1	5,1	5,0	0,139			W.	W. by NW.	SE.	do	do	do
31	,901	,938	,900	,864	,830	,858	—	81,8	82,2	84,7	85,4	85,0	83,9	—	4,9	8,2	5,7			2,198	W.bySW.	W.	W.byNW.	do	do	Haze
Mean	29,861	29,895	29,874	29,834	29,820	29,845	29,853	78,4	82,5	84,9	85,9	83,8	82,9	83,7	4,1	8,1	5,4	—	—	—						

METEOROLOGICAL JOURNAL FOR THE MONTH OF SEPTEMBER, 1836.

Days.	Barometer at Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.	Thermometer at Sun rise.	10 A. M.	Noon.	2 P. M.	Sun set.	8 P. M.	10 P. M.
1836	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	°	°	°	°	°	°	°
Sept 1	29,898	29,918	29,876	29,842	29,810	29,826	—	79,8	81,2	83,7	83,9	82,3	81,8	—
2	,850	,880	,866	,828	,816	,856	—	82,0	80,5	82,8	84,0	82,6	82,1	—
3	,852	,882	,870	,832	,792	,828	—	81,4	82,1	86,0	86,8	85,4	83,1	—
4	,874	—	,863	,852	,834	,870	—	82,3	—	85,2	86,4	86,3	85,4	—
5	,866	,920	,898	,854	,828	,856	—	82,0	85,2	86,6	87,0	86,0	84,8	—
6	,864	,896	,878	,851	,846	,896	—	81,1	85,8	87,0	88,8	86,8	85,1	—
7	,900	,950	,914	,884	,872	,924	—	79,2	85,7	86,7	88,3	85,0	84,2	—
8	,936	,980	,950	,910	,906	,938	—	82,1	86,0	88,0	87,2	83,3	83,9	—
9	,986	30,052	30,036	30,013	,978	30,010	—	81,8	86,3	88,0	87,9	86,0	85,1	—
10	30,036	,070	,060	29,986	,970	,016	30,032	80,1	84,9	87,2	88,6	87,0	85,2	84,7
11	,018	30,046	29,998	,950	,924	29,930	—	80,6	85,8	87,8	88,1	85,8	84,3	—
12	29,974	,020	,968	,913	,914	,964	29,990	77,3	84,4	87,0	87,1	85,0	83,8	82,3
13	,950	,040	,992	,944	,922	,958	—	76,1	84,3	86,6	87,0	85,9	83,9	—
14	,954	29,966	,944	,916	,904	,928	,930	76,2	84,3	87,3	88,0	86,0	84,2	83,8
15	,912	,950	,930	,916	,872	,882	,892	77,2	85,3	86,9	87,0	84,1	83,7	83,0
16	,886	,998	,938	,872	,866	,878	,894	77,6	84,8	88,2	87,8	85,3	84,8	83,7
17	,885	,912	,898	,858	,836	,826	—	77,5	86,2	89,0	82,6	82,0	80,2	—
18	,896	—	,894	,858	,856	,890	—	80,0	—	86,5	90,3	84,8	84,6	—
19	,878	,952	,942	,890	,862	,900	—	79,8	85,8	88,0	93,0	86,4	85,3	—
20	,900	,938	,924	,900	,888	,906	,932	81,0	86,3	89,7	87,4	86,0	84,7	85,0
21	,916	,976	,960	,890	,894	,948	—	78,8	84,5	87,0	91,0	86,2	85,8	—
22	,962	,998	,970	,938	,922	,954	,994	76,0	84,2	87,0	88,6	86,2	84,9	84,4
23	30,002	30,016	30,006	,968	,918	,950	,976	78,9	83,9	86,7	88,4	86,3	85,0	84,3
24	29,970	29,976	29,974	,935	,898	,922	—	80,7	85,2	87,5	87,2	83,5	81,5	—
25	,900	,972	,934	,910	,888	,906	—	76,2	84,0	85,2	86,1	84,8	81,8	—
26	,906	,946	,938	,904	,900	,916	—	76,0	85,2	87,8	91,0	88,0	85,3	—
27	,912	,938	,920	,883	,870	,914	—	76,2	85,8	88,5	89,8	83,0	80,6	—
28	,890	,910	,888	,858	,846	,866	—	74,0	84,9	89,7	89,9	85,0	82,9	—
29	,840	,870	,866	,942	,828	,884	—	74,1	86,4	91,2	88,2	86,2	84,1	—
30	,908	,946	,920	,876	,876	,906	,930	74,0	85,7	88,0	89,7	86,3	85,0	81,2
Mean	29,917	29,961	29,934	29,899	29,878	29,908	29,952	78,7	84,8	87,2	87,9	85,2	83,9	83,6

Days.	Dep. of wet bulb Therm. Sun rise.	Noon.	Sun set.	Rain. Sun rise.	Sun set.	Evaporation.	Direction of Wind. Morning.	Noon.	Evening.	Remarks. Morning.	Noon.	Evening.
1836	°	°	°	Inch	Inch	Inch						
Sept 1	4,2	10,5	5,0	0,076			sw.	nw.	ne.	Cloudy	Cloudy	Cloudy
2	5,8	8,7	6,0	0,104			w.	w.	ne.	do	do	th. & light
3	3,8	9,0	6,7				w. by sw.	w.	s.	do	Haze	do
4	6,1	8,2	8,7				w.	w.	ssw.	do	Cloudy	lightng.
5	6,0	9,9	6,6				sw.	w.	s.	Haze	do	cl. light
6	4,4	10,6	6,0				sw.	nw.	se.	do	Haze	fl. cls. lt.
7	4,0	11,7	7,1			2,097	sw.	w.	se.	do	clear	cl. litng.
8	5,6	11,6	5,2				sw.	e.	se.	do	F. C.	cl. haze
9	4,1	9,2	7,5				n.	se.	e by se	F. C.	Clear	Cloudy
10	4,5	10,9	7,3				sw.	nw.	e.	Cloudy	F. C.	haze light.
11	4,6	9,9	6,2				sw.	se.	s.	Haze	Clear	fl. cls. th. &lt.
12	5,2	7,6	9,6	0,056	0,052		sw.	w.	s.	F. C.	F. C.	fl. cls. lt.
13	3,5	8,8	7,0				w. by sw.	se.	s.	Clear	F. C.	clear light.
14	4,4	10,3	6,5			2,559	sw.	w.	se.	do	F. C.	clear th. &lt.
15	3,9	8,2	5,7				n.	e.	se.	do	Cloudy	haze th. &lt.
16	3,5	11,0	7,4				nw. by w.	e.	e.	do	F. C.	do
17	4,0	9,2	4,6	0,031	0,292		w.	n.	nw.	Haze	do	cly. thunder
18	2,8	8,5	9,4				sw.	w.	nw.	do	Haze	fly. cls. lt,
19	4,3	11,0	6,6				sw.	n.	s.	Clear	Th. haze	clear lt.
20	5,1	12,7	6,3		0,028		sw.	n.	s.	F. C.	F. C.	haze light.
21	4,0	8,0	6,2				s.	sw.	s.	Haze	do.	do.
22	4,0	8,2	7,0	0,211			w.	nw.	se.	Cloudy	do.	cl. th. & lt.
23	4,4	8,7	6,3				w.	w.	s.	do.	Clear	do.
24	4,1	10,5	7,2				w.	w.	sw.	do.	Cloudy	cy. th. &lt.
25	5,5	10,0	10,9				w.	w.	sw.	Th. haze	Haze	Haze do.
26	5,4	11,6	9,3				sw.	nw.	e.	Haze	do.	do.
27	4,2	12,3	7,4				e.	nw.	n.	Haze	Th. haze	Cly. lt.
28	4,8	12,9	6,9	0,008		4,274	sw.	n.	sw.	do.	F. C.	do.
29	3,8	17,1	8,5				s.	nw.	e.	do.	do.	Cl. ltg.
30	6,3	13,0	11,9				sw.	sw.	se.	do.	do.	do.
Mean	4,5	10,3	7,2	—	—	—						

The instruments* with which the foregoing observations have been made, are placed upon a table about 4 feet above the ground in the western verandah of the Honorable Company's Observatory; which is situated in the longitude 5h. 21m. 9s. E. and latitude 13° 4′ 9″ N. at about 2 miles from the sea and about 27 feet above the low water mark.

T. G. Taylor,
H. C.'s Astronomer.

1*st October* 1836.

* For the particulars relative to these Instruments see *Madras Results*, Vol. II.

Notes.

While the last pages were passing through the press, a communication from the Madras Government has been addressed to the Committee of the Madras Literary Society, intimating that the Government of India has adopted the recommendation of the Asiatic Society of Bengal, conveyed in their Resolution at the Meeting of the 7th of September last, grounded on the opinion of the Committee of Papers then submitted. We rejoice heartily at the patronage of Government having been thus extended to a feasible project for the elucidation of the history, literature and antiquities of southern India; and we congratulate oriental scholars at the prospect they now enjoy of having extensive stores of knowledge opened to their researches. Of course no time will be lost in communicating with Mr. Taylor on the subject, and particulars may be looked for in our next issue.—*Editor.*

We regret that circumstances prevented the registry of the horary meteorological observations on the appointed days in September; we believe we may confidently state that no disappointment will occur in future.—*Editor.*

Corrigenda.

Page 326—for BC, BF, FD and DC,
read BE, BF, FD and DE.

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ERRATA.

Page 339, line 20, for "looked into" read "broken into."
,, 27, line 30, for "re-conformations" read "recent formations."
,, 219, line 24, for "these" read "this."
,, 304, line 32, for "*putoria*" read "*pictoria.*"

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ERRATA.

Page 38, line 15, for "Ozuri," read "Azuri."

,, 145, ,, 24, for "calcedony," read "chalcedony."

,, 156, last line, put a , after the word calcination.

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